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Geology of the

Slate Falls Area

District of Kenora
(Patricia Portion)

by
Henry Wallace

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FOREWORD

SLATE FALLS AREA

This report is the first in a series describing the geology and mineral potential of the central portion of the Uchi Subprovince, terrain previously known only through reconnaissance surveys. Although occurrences of gold, molybdenum, copper, and uranium are known in the Slate Falls Area; exploration efforts there have been quite limited by lack of geological data. The present mapping program, begun in 1977, will update and expand publicly available geological information on the area between Birch Lake and Pickle Lake, and thus facilitate and encourage more effective mineral exploration and resource planning across this region.

V.G. Milne
Director
Ontario Geological Survey

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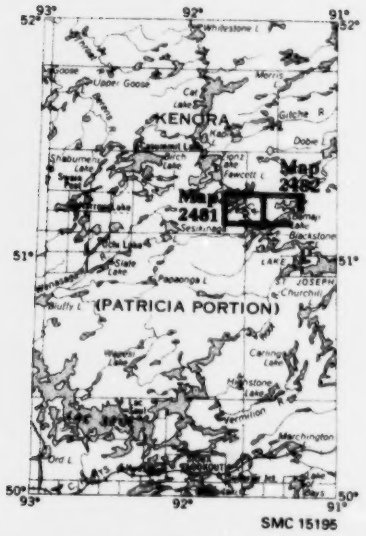
(back pocket)

Map 2481 (coloured)–Wesleyan Lake, Kenora District.
Scale 1:31 680 or 1 inch to ½ mile.

Map 2482 (coloured)–Moosetegon Lake, Kenora District.
Scale 1:31 680 or 1 inch to ½ mile.



SMC 15195

Figure 1–Key map showing location of the Slate Falls Area. Scale 1:3 168 000 (1 inch to 50 miles).

ABSTRACT

The Slate Falls map area lies approximately 120 km north of Sioux Lookout, and covers some 570 km^2. All bedrock in the region is of Archean age. Roughly one-half of the map area is underlain by a belt of supracrustal rocks. The oldest part of the belt consists of metavolcanics which form two distinct sequences. The lower sequence is a mixed calc-alkaline succession of mafic to intermediate flows intercalated with intermediate pyroclastic units; these are conformably overlain by an upper monotonous succession of tholeiitic mafic flows. Clastic metasediments, mostly conglomeratic and metawacke-mudstone sequences unconformably overlie these metavolcanics and are in turn overlain by a thin sequence of much younger intermediate pyroclastic rocks. Metamorphic mineral asssemblages are characteristic of medium grade (cordierite-almandine) conditions.

The supracrustal sequences are intruded and nearly surrounded by several major plutons of trondhjemite, granodiorite, quartz monzonite, and syenodiorite. In general trondhjemitic phases are oldest and quartz monzonites are youngest in the intrusive sequence. Innumerable minor intrusions ranging in composition from peridotite to granitic pegmatite also cut the supracrustal rocks, but nearly all appear to predate the major intrusion.

The metavolcanics and metasediments have been tightly folded along east- to northeast-plunging axes, leaving the major lithologic subdivisions roughly symmetrically arranged about the length of the belt. Intense cataclastic deformation related to major faults occurred late in the tectonic history of the area.

Deposits of gold and of molybdenite associated with sulphide-bearing quartz veins are known in several localities within the map area. An unusual deposit of uranium-thorium-gold in the central part of the area appears to be related to calcareous clastic and chemical metasediments.

Surficial Pleistocene and Recent deposits are quite thin and form few prominent topographic features.

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CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

If the reader wishes to convert imperial units to SI (metric) units or SI units to imperial units the following multipliers should be used:

CONVERSION FROM SI TO IMPERIAL			CONVERSION FROM IMPERIAL TO SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
		LENGTH			
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
		AREA			
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
		VOLUME			
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
		CAPACITY			
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
		MASS			
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
		CONCENTRATION			
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

1 ounce (troy)/ton (short)	20.0	pennyweights/ton (short)
1 pennyweight/ton (short)	0.05	ounce (troy)/ton (short)

NOTE–Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries published by The Mining Association of Canada in co-operation with the Coal Association of Canada.

Geology of the

Slate Falls Area

by

Henry Wallace[1]

INTRODUCTION

This report describes the geology of some 570 km^2 around the small Indian community of Slate Falls, which is about 120 km north of Sioux Lookout (*see* Figure 1). The accompanying geological maps (back pocket) cover the area bounded by Latitudes 51°07.5′N and 51°16′N and Longitudes 91°15′W and 91°45′W. The eastern two-thirds of this area falls within the Patricia Portion of the Kenora Territorial District, while the western part belongs to the Red Lake Mining Division. This project began an ongoing Ontario Geological Survey program to map in detail the central portion of the Uchi Subprovince previously surveyed at only reconnaissance scale (Sage and Breaks 1976).

Access

Access to the area is restricted to float- or ski-equipped aircraft available for charter from Sioux Lookout, Red Lake, and Pickle Lake. Within the area, excellent water access is provided by the extensive lake system including Fry, Bamaji, North Bamaji, Wesleyan, and Kezik Lakes, which interconnect with large lakes of the Cat River drainage system to the northwest and south. Minor portages are necessary around the Fry Lake-Bamaji Lake Falls, and around Slate Falls and the adjoining rapids. The portage between northern Wesleyan Lake and the Cat River is approximately 400 m long.

The nearest road, all-weather Highway 599, passes about 80 km to the east of the map area, and can be reached fairly easily by boat or snow vehicle via Roadhouse Lake, Blackstone Lake, and Lake St. Joseph.

Frequent aircraft traffic from Sioux Lookout services the community at Slate Falls.

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[1]Geologist, Precambrian Geology Section, Ontario Geological Survey, Toronto. Manuscript approved for publication by the Chief Geologist, June 8, 1980.
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Slate Falls Area

A major hydro-electric transmission line extending from Ear Falls to Pickle Lake transects the map area. Much of the line is passable by all-terrain vehicles but it is now patrolled infrequently by helicopter.

Present Geological Survey

Field work for this report was done by the author and assistants during the summers of 1977 and 1978. About eighty percent of the area, including all of those parts underlain by supracrustal rocks, was mapped by pace-and-compass traverses at roughly right angles to the regional structural trend and at intervals from 300 to 800 m apart depending upon the amount of exposure and the geological complexity expected. The traverses were run between topographic features across potential outcrop areas visible on vertical airphotos. Outcrop exposed along the shores of major lakes and river systems was also examined. In some parts of the area such as the extreme northwestern and southeastern corners which are exclusively underlain by granitoid rocks, no overland traverses were carried out because information from lakeshore mapping was deemed adequate for consistent geological interpretation. Several localities of known mineralization such as the Moosetegon Lake Uranium Occurrence, and the Loon Molybdenum Prospect were examined and mapped in more detail using grid systems.

Field data were recorded on transparent acetate overlays attached to the black-and-white vertical air photographs (scale 1:15 840) provided by the Silviculture Section, Public Service Centre, Ministry of Natural Resources. The information was later plotted at the same scale on cronaflex base map sheets supplied by the Cartographic Section, Ontario Division of Lands, Ministry of Natural Resources. Outcrop areas were generalized to allow for reduction of the map to the publication scale of 1:31 680. Uncoloured preliminary maps of this area at a scale of 1:15 840 were issued in 1979 (Wallace 1979a,b).

Previous Geological Work

Up until 1977 when the current mapping program began, geological work in this area had been restricted to large scale reconnaissance mapping. Most of the present map area was surveyed by Harding (1935) at a scale of 1:126 720. In 1960 it was mapped by Elmslie (1960) at 1:253 440 as part of the federal government's "Roads to Resources" program. Most recently mapping was done in 1972 as part of Operation Pickle Lake (Sage and Breaks 1976) from which maps were prepared at a scale of 1:126 720. Recommendations for more detailed mapping of certain areas in the region covered by Operation Pickle Lake led to the inception of the current program.

Most of the map area was included in a high resolution aeromagnetic survey flown in 1975 (ODM 1976a,b,c,d,e,f). This resulted in a major improvement of geological interpretation over previously available aeromagnetic maps (ODM-GSC 1960a,b,c,d).

Prest (1963) compiled data on Pleistocene deposits in this region and published a surficial geology map at a scale of 1:506 880.

History of Mineral Exploration

Prospecting for gold began in this region in the late 1920s after discoveries around Red Lake to the west and Pickle Lake to the east. In 1927 a gold prospect was staked by P. Tivy near the southwestern shore of Wesleyan Lake (Laird 1930, p.22). The same ground was restaked and worked extensively by A.B. Connell, J.H. Stirrett and S. Williams in 1934 (Harding 1935, p.68). In 1971 Cochenour-Willans Gold Mines Limited did some prospecting and shallow diamond drilling in this general vicinity. A second gold occurrence was found by Connell Mining and Exploration Company Limited on the north shore of Fry Lake in 1935 (Harding 1935, p.69). This property was acquired in 1946 by Flicka Red Lake Gold Mines Limited, and prospecting, trenching and diamond drilling took place between 1946 and 1948 (Mineral Deposit Files, Geoscience Data Centre, Ontario Geological Survey, Toronto).

A gold-silver occurrence at the eastern end of North Bamaji Lake was trenched in 1965 by Dome Mines Limited and Sigma Mines (Quebec) Limited, but only low values were reported (Resident Geologist's Files, Ministry of Natural Resources, Sioux Lookout). In the same area in 1974 Dome Exploration (Canada) Limited performed ground magnetometer and electromagnetic surveys.

The Sanderson Option, a gold-silver occurrence located about 5 km northeast of Slate Falls was investigated in 1966 by Cochenour Willans Gold Mines Limited. Extensive stripping, trenching and diamond drilling was carried out (Sage and Breaks 1976, p.322).

Uranium occurrences were discovered south of Moosetegon Lake in 1953 by McCombe Mining and Exploration Limited. Shallow diamond drilling was done at that time (Resident Geologist's Files, Ministry of Natural Resources, Sioux Lookout). This area was re-examined by Kirkland Townsite Gold Mines Limited in 1968 when an airborne gamma ray spectrometer survey was flown, and geological mapping and considerable trenching took place (Resident Geologist's Files, Ministry of Natural Resources, Sioux Lookout). From 1969 to the present R. Knappett has done further prospecting and trenching in the area. A number of smaller uranium-thorium showings have been located by Mr. Knappett east of the eastern end of North Bamaji Lake, and gold values have been reported along with the uranium-thorium (R. Knappett, personal communication). A small copper-silver occurrence just south of the easternmost extremity of North Bamaji Lake was also found by Mr. Knappett.

Several occurrences of molybdenite with pyrite and in some cases with chalcopyrite have been found around North Bamaji Lake since the discovery of the Loon Prospect (Sage and Breaks 1976, p.319) on the north shore of the largest island in the lake in the early 1960s. From 1965 to 1968 Cochenour Willans Gold Mines Limited did trenching, geological mapping, and diamond drilling around the Loon Prospect site (Resident Geologist's Files, Ministry of Natural Resources, Sioux Lookout).

Slate Falls Area

In the period from 1969 to 1974 a great deal of exploration activity occurred across this region principally in search of base metal sulphide deposits. In 1970, Canadian Onex Mines Limited flew a combined airborne magnetometer and electromagnetic survey over the central part of the map area. This was followed up in 1971 with an induced polarization survey in the area to the north of North Bamaji Lake (Assessment Files Research Office, Ontario Geological Survey, Toronto).

In 1970-1971 Cochenour Willans Gold Mines Limited, in a joint project with Selco Exploration Company Limited, performed a combined airborne geophysical survey covering much of the present area. This was followed immediately by a large number of ground magnetometer and electromagnetic surveys, geological and geochemical mapping and sampling programs, and considerable drilling scattered throughout those parts of the area underlain by supracrustal rocks (Assessment Files Research Office, Ontario Geological Survey, Toronto).

In 1973 another airborne geophysical survey, including most of the present area, was commissioned by Union Miniere Exploration and Mining Limited. Diamond drilling of anomalies southwest of the western end of Fry Lake, north of Rockmere Lake, and in the northeastern corner of the map area took place in 1974 (Assessment Files Research Office, Ontario Geological Survey, Toronto).

As of December 31, 1978 the only mining claims in good standing in the map area were a block of 23 claims held by Urangesellschaft Canada Limited around the Bamaji Lake Uranium Occurrence south of Moosetegon Lake.

Natural Resources

Most of the area is forested with black spruce and balsam fir. Poplar, white birch, and jackpine occur in localities with better drained sandy soil. White cedar, larch, and ash are relatively uncommon but widely distributed.

Excellent sports fishing is available on many of the lakes and rivers in the area, where pickerel, pike, and lake trout are abundant. From time to time small scale commercial fishing has been carried out on the larger lakes. Fur bearing animals seen by the field parties in 1977 and 1978 include beaver, muskrat, otter, marten, fisher, and mink. Beaver and muskrat in particular are trapped in considerable number by the local residents. Black bear, moose, and woodland caribou were encountered during this survey but they do not appear to be numerous. Waterfowl, mostly common loon, common merganser, and common goldenye ducks were seen frequently in all parts of the area. Bald eagle, osprey, and gyrfalcon were among the other species of birds identified.

Inhabitants

The settlement of Slate Falls, on the northwestern shore of North Bamaji Lake, has a population of approximately 40 year-round inhabitants. Many of the 20 to 30 log buildings around the lakeshore are abandoned. By far the largest structures are the school, built in 1978, and the residence of the Mennonite

missionaries who provide the Indians with medical and educational aid. A number of cabins in the settlement belong to Slate Falls Airways of Sioux Lookout who operate a sports fishing and hunting service in the area.

There are no stores of any kind in the settlement. Food and other provisions are flown in as required from Sioux Lookout or Osnaburgh. Largely because of this, a satellite-relay telephone system was installed in 1977 to supplement the less reliable radio communications system.

From spring to fall many of the people of Slate Falls work in some capacity for the visiting sports fishermen and hunters. Others engage in commercial fishing on Fry and Roadhouse Lakes. Some residents work as fire-fighters or tree planters during the spring and summer, and trap during the fall and winter.

A second small settlement is located on the northern shore of Bamaji Lake just south of the Fry Lake-Bamaji Lake falls. In 1977 about 15 people lived in six cabins on the north side, and several more lived across the lake in tents and newly constructed cabins. In 1978 this small hamlet was said to have been abandoned, the former residents having moved to Slate Falls and Osnaburgh on Indian Reserve 63B about 75 km to the west.

Two small outpost camps for sports fishermen and hunters are supplied by boat and aircraft from Slate Falls. One is located on the north side of Bamaji Lake opposite the largest island in the lake, and the other is on the large peninsula on the south side of central Wesleyan Lake.

During much of the field work for this project, the mapping crews lived in two cabins formerly used by Ontario Hydro. Before the use of helicopters to patrol and defoliate the transmission lines, maintenance personnel were regularly stationed in these "patrol houses" which occur at approximately 30 km intervals along the lines. One of these cabins is located on the northeastern shore of Konegon Lake. The other is just east of the Fry Lake-Bamaji Lake falls.

Topography, Outcrop Distribution, and Drainage

Relief in this region is quite variable, the maximum difference in elevation within the map area being about of 50 m. Bold outcrops of granitoid rock up to 25 to 30 m in height occur fairly commonly in the northwestern and southeastern parts of the area, and high (up to 30 m) terraced ridges of metavolcanic rock line much of the northern shore of Bamaji Lake and the southern shore of western Fry Lake. Within the area underlain by supracrustal rocks, the outcrop generally forms ridges extending parallel to strike, separated by linear, often swampy depressions.

With a few exceptions the degree of exposure is fair to good, indeed large parts of the map area have between 30 to 50 percent outcrop. The areas directly south of Konegon Lake, directly north of the central part of North Bamaji Lake, and north of the eastern end of Fry Lake, are mostly low-lying with less than 5 percent exposure.

The only notable Pleistocene feature is a southwest-trending esker north of Kaginot Lake. Throughout most of its traceable length the esker is flanked by a gently sloping apron, but in a few places it is characterized by very steep sides

and sinuous outline. Over these stretches it is estimated to be up to 20 m in height.

Drainage in the area is toward Bamaji Lake. Kezik, Wesleyan, North Bamaji and Bamaji Lakes all form part of the Cat River system which continues to the south into Roadhouse and Blackstone Lakes and ultimately into Lake St. Joseph and the Albany River. Most of the area, with the exceptions of the low-lying tracts noted above, is well drained with few prominent swamps. Much of the local lakeshore is lined by outcrop and boulder beaches but extensive marshes do occur in some bays. The amount of lakeshore outcrop in many parts of the area is very much dependent upon water level which rose by a full metre between the summers of 1977 and 1978.

Acknowledgments

The author was ably assisted in the field in 1977 by D.A. Smith, B.A. McRae, M. Wright, and T.C. Stubens; and in 1978 by R.V. Zalnieriunas, I.G. Sutherland, M. Atkinson, B. Christie, J.M. Pautler, and L. Cymbalisty. Messieurs Smith, Zalieriunas and Sutherland as senior assistants were directly responsible for much of the mapping and geological interpretation done for this project. Considerable independent mapping was also done by Mrs. McRae and Miss Atkinson in the latter parts of their respective field seasons.

The detailed mapping of molybdenum deposits in the area was done by Mr. Sutherland. Likewise, Mr. Christie was responsible for work around the Moosetegon Lake Uranium Occurrence, and Mr. Zalnieriunas for work on the Sanderson Option.

The co-operation of the following individuals is gratefully acknowledged: R. Knappett, prospector; D.A. Hutton, Selco Mining Corporation Limited; W. Bale, Urangesellschaft Canada Limited; and K.B. Kramer, Ontario Hydro.

GENERAL GEOLOGY

Roughly one half of the map area is underlain by a belt of Early Precambrian metavolcanics and metasediments which has been folded along east-northeast-trending axes. This supracrustal belt consists predominantly of metavolcanic rocks, including a lower sequence of intermixed calc-alkaline mafic to intermediate flows and intermediate to felsic pyroclastic rocks, and an upper sequence of mafic tholeiitic flows which conformably overlies the lower sequence. Stratigraphically above, and in part intercalated with these metavolcanics are conglomeratic and metawacke-mudstone successions. Unconformably overlying those clastic metasediments is a thin sequence of metavolcanics, predominantly intermediate pyroclastic rocks which appears to represent a third discrete cycle of volcanism.

A complex variety of felsic to ultramafic rocks intrusive into the supracrustal rocks are all believed to be Early Precambrian in age. Plutonic masses ranging in composition from trondhjemitic to granitic almost completely surround the "greenstone" belt.

TABLE 1 | **TABLE OF LITHOLOGIC UNITS FOR THE SLATE FALLS AREA.**

PHANEROZOIC

CENOZOIC

QUATERNARY

PLEISTOCENE AND RECENT

Till, sand, gravel, boulders (moraine and esker deposits).

Unconformity

PRECAMBRIAN

EARLY PRECAMBRIAN (ARCHEAN)

INTRUSIVE ROCKS

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

Massive biotite trondhjemite; foliated and gneissic biotite trondhjemite; porphyritic biotite trondhjemite; hornblende and biotite-hornblende trondhjemite and quartz diorite; biotite granodiorite; porphyritic biotite granodiorite; biotite and hornblende-biotite quartz monzonite and granodiorite; porphyritic biotite quartz monzonite; porphyritic hornblende granodiorite and syenodiorite; feldspar-quartz porphyry[c] and quartz porphyry;[c] quartz-feldspar-porphyry and feldspar porphyry[c]; pegmatite and aplite; felsite.

Intrusive Contact

MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

Metagabbro, porphyritic metagabbro, metadiorite and quartz diorite; metapyroxenite; metaperidotite; lamprophyre; porphyritic andesite (dikes).

Intrusive Contact

METAVOLCANICS AND METASEDIMENTS[a]

CHEMICAL METASEDIMENTS

Chert; interbedded quartz-magnetite ironstone and chert; calc-silicate (actinolite-dolomite-calcite-biotite-quartz) rock.

CLASTIC METASEDIMENTS

Slate, argillite, feldspathic wacke, lithic wacke; pebbly sandstone, pebble and cobble conglomerate; biotite-plagioclase-quartz schist, paragneiss and migmatite.

FELSIC TO INTERMEDIATE METAVOLCANICS[b]

Massive flows, pillowed flows; lithic and crystal tuff; lapilli-tuff, lapillistone, tuff-breccia.

MAFIC TO INTERMEDIATE METAVOLCANICS

Massive flows, pillowed flows; pyroclastic rocks; amphibolite, garnetiferous amphibolite; coarse amphibolite[a] migmatized mafic metavolcanics.

Notes:

(a) Metavolcanic and metasedimentary successions are interlayered, their sequence in this table does not imply consistent relative ages.

(b) May in part be intrusive.

(c) May in part be extrusive.

Regional metamorphism ranges from low to in some places medium grade (Winkler 1976). Superimposed upon these effects in much of the southern half of the area, are broad zones which have been subjected to varying degrees of cataclastic recrystallization.

Quaternary overburden is quite thin across this region, and there are few major Pleistocene morphological features.

A generalized summary of the rock-types occurring within the map area is given in Table 1.

Note that in the following sections which describe the supracrustal lithologies of this area, all rocks are metamorphic, none have retained their original mineralogy and/or texture. The prefix "meta-" has been omitted for brevity when referring to individual rock types and will only be used in the general sense i.e. metasediments and metavolcanics.

Early Precambrian (Archean)

METAVOLCANICS

Mafic to Intermediate Metavolcanics

Metavolcanics described in this part of the report range in composition from basaltic komatiite to andesite but most are certainly basaltic (*see* Petrochemistry of Metavolcanics). Rocks in these categories underlie approximately 22 percent of the map area, and are concentrated in its northeastern quadrant.

For field purposes "mafic to intermediate" rocks were defined as those having colour indices (volume percentage of dark coloured minerals) greater than 25 percent. In many cases compositions were confirmed by petrographic and/or chemical analysis.

Primary structures such as pillows, tephra, varioles, amygdules, etc. are commonly present to varying degrees in these rocks. Where such features have been positively identified the rocks have been classified as pillowed flows, massive flows, pyroclastic rocks, etc., but where they have been obliterated by metamorphism and tectonism, the rocks have been coded simply as amphibolite, garnetiferous amphibolite or coarse amphibolite (grain size 0.5 cm). Most of these amphibolites are undoubtedly mafic metavolcanics but in some places, particularly in the area north and east of Kaginot Lake, units believed to be coarse amphibolites are indistinguishable from metagabbroic intrusive rocks.

The mafic metavolcanics are described below according to their stratigraphic relationships in several sections through the area (*see* Figure 2). Figure 2 also shows the aerial distribution of volcanic rocks assigned to the lower and upper metavolcanic sequences and the Bamaji Lake pyroclastic sequence (*see* General Geology). These three sequences are believed to represent discrete volcanic cycles with marked lithologic and petrochemical differences (*see* Petrochemistry of Metavolcanics, *and* Stratigraphy).

A petrographic summary utilizing data from all sections in Figure 2 is

made separately at the end of this part of the report.

NORTHERN FRY LAKE SECTION (A-B)

On the northern side of the Fry Lake Anticline (*see* Structural Geology) mafic metavolcanics make up roughly 60 percent of this cross section, with felsic to intermediate pyroclastic rocks and mafic intrusive rocks constituting the remainder. The pyroclastic rocks occur as relatively thin units intercalated with the more mafic flows, and also combine to form a continuous succession up to 700 cm thick along the northern side of the lake. The metagabbroic component of the cross-section occurs mostly as sill-like bodies.

The mafic metavolcanics in the northern part of this section are predominantly fine-grained pillowed and massive basaltic flows. The massive flows commonly contain scattered quartz-filled amygdules and plagioclase phenocrysts up to 0.5 cm long. Concentration of amygdules near flow tops, and fragmental flow tops can in some cases be used to infer facing in these flows but commonly contacts between flows are very difficult to detect.

Close packing of pillows in pillowed flows is the general rule, but because of pronounced tectonic flattening, they can rarely be used to determine stratigraphic tops. Average pillow size ranges from 15 cm to a metre in the long dimension. The smaller pillows seem to occur in andesitic flows, while the larger tend to predominate in mafic (basaltic) units. The pillow selvages are black, weather low, and range from 2 to 5 cm thick. Internally the pillows appear to be compositionally homogeneous. Varioles are rare, but small radially arranged vesicles are common within the pillows particularly near their margins where they make up between 5 to 20 percent of the rock. Pillow breccias can be recognized between pillowed flows in a few places, and units of fine fragmental material between flows are believed to be hyaloclastic in origin.

Mafic pyroclastic rocks are not common. They do occur within the intermediate to felsic sequences as minor tuff to lapilli tuff beds only a few centimetres thick interlayered with more felsic units of similar dimensions.

Near the extreme northern end of this section the volcanic features become more difficult to recognize and grain size increases so that many outcrops were classified simply as amphibolite except where gross features such as pillows were still discernible. Textures in these flows vary from granoblastic to schistose and porphyroblastic. Quartz lenses which may have been amygdules are common in most units.

The part of this section south of the anticlinal axis is comprised of a lower sequence, rather similar to that in the north in terms of the relative proportions of mafic metavolcanics, felsic to intermediate pyroclastic rocks and mafic intrusive rocks, and an upper sequence which consists almost exclusively of mafic flows. As will be shown in a later section of this report (*see* Petrochemistry of Metavolcanics) these two sequences exhibit markedly different chemical characteristics. The general features of those flows in the lower sequence are as described previously for rocks on the northern limb of the anticline. They are aphanitic to fine-grained pillowed and massive flows about 10 m thick with the massive flows typically thicker than pillowed flows.

Approximately 90 percent of this section between the western arm of Fry Lake and the southern end of the section line consists of mafic pillowed and massive flows. The remaining 10 percent is made up of rare felsic and mafic pyroclastic intercalations and several minor metagabbroic and felsic porphyry intrusions. Typically the pillows from this area are well-formed and closely packed so that good top determinations can be made on many outcrops. Selvages are generally thicker (4 to 6 cm) than in flows in the lower metavolcanic sequence. Flow thickness is difficult to estimate since interflow autoclastic breccia and other distinct intercalations are relatively uncommon. Most of the rocks are aphanatic to fine-grained, but some units are medium-grained granoblastic, blasto-ophitic or porphyroblastic amphibolite. Amygdules are relatively uncommon, but several flows are variolitic. Although the varioles are generally small (1-3 mm) they can constitute a high proportion (20 to 50 percent) of the interiors of pillows in some units.

Several flows exposed in the southwestern bay of Fry Lake have distinctly different mineralogy and texture from the amphibolite units discussed above. These rather anomalous rocks are coarse- to medium-grained, equigranular to porphyroblastic "actinolitites" commonly rich in carbonate minerals. In some places large (1 to 1.5 m long) rather nebulous pillows with thin (1-2 cm) selvages can be discerned in the flows but most appear massive.

FRY-BAMAJI LAKE SECTION (C-D)

The northern part of this section, around the southeastern bays of Fry Lake is correlative with the upper sequence in the Northern Fry Lake section just described, and is very similar lithologically. Pillowed flows with well-formed pillows up to 2 m long are predominant but massive units are also common. Interflow material makes up only a small fraction of the sequence. Crenulated chloritic schist units believed to be mafic tuffs were noted in several places but these are thin and discontinuous. Intermediate pyroclastic units intercalated with the mafic flows are also volumetrically insignificant. Felsic porphyry intrusions into the metavolcanics are ubiquitous but most are less than 1 m thick.

Toward Bamaji Lake marked changes in the lithologies are encountered. The rocks become coarse-grained and commonly porphyroblastic. Pillows, amygdules and other features become progressively deformed and difficult to identify, and metamorphic differentiation produces gneissic layering in some originally massive units. The overall character of the volcanic succession also changes toward the south. Although recognizably pillowed flows are still very common, mafic to intermediate pyroclastic units become more abundant. Indeed near Bamaji Lake these pyroclastic units and layered amphibolite and garnetiferous amphibolite units derived from them definitely predominate. Most of these rocks are monolithic and quite coarse, in the lapilli-tuff to tuff-breccia range. Bedding defined by fragment size gradation is observed in a few exposures.

The wedge of conglomeratic and metawacke units around the Fry-Bamaji Lake falls marks an erosional unconformity (*see* Bamaji Lake Conglomerate

Sequence). The metavolcanics which outcrop along the north side of Bamaji Lake near this cross-section are above the unconformity, and are distinctly different from those below. Along this shore mafic flows and pyroclastic rocks occur intercalated with more felsic pyroclastic units, and all are strongly sheared and injected with quartz veinlets due to their proximity to the Bamaji Lake Fault Zone (*see* Structural Geology), making their classification difficult. The mafic metavolcanics in this part of the section are mostly garnetiferous amphibolites. Commonly these are layered, and in many the layering can be attributed to highly flattened pillows or tephra. In some outcrops the layering is highly contorted and the original nature of the rock has been completely disrupted.

ROCKMERE LAKE SECTION (E-F)

The northern part of this section near Fry Lake consists of aphanitic to medium-grained massive and pillowed mafic flows in approximately equal proportions. Interflow clastic metasediments and pyroclastic rocks were found in only very minor amounts. This part of the Rockmere Lake Section is correlative with the southern part of the Northern Fry Lake Section. In general lithologies are similar to the rocks of the upper metavolcanic sequence as described in that section.

Around Rockmere Lake, on both sides of the Rockmere-Wesleyan Lake Syncline (*see* Structural Geology) there is a distinctive sequence of flows which may be correlative with the unusual units found around the southwestern bay of Fry Lake at the southern end of the Northern Fry Lake Section, but evidence for this correlation is purely circumstantial. The flows in question display a coarse spinifex-like texture (Photo 1) which in most units can readily be seen on outcrop. Many are also characterized by concentrations of large (up to 3 cm in diameter) elongated feldspathic varioles which parallel the major fold axes nearby. Both massive and pillowed flows have these features. In the pillowed units the varioles are relatively small (0.5 to 1 cm) and occur in the pillow rims but not the selvages themselves. In the massive flows, the varioles are concentrated in conformable layers and may represent separate flow units or the effects of flow differentiation (Gelinas *et al.* 1976).

Thin sections of these flows reveal that they consist of skeletal blades of actinolite probably after pyroxene grains. The actinolite crystals form sheaf-like bundles anywhere from 0.3 mm to 1.5 cm long in a groundmass of asbestiform very fine tremolite which may represent devitrified glass. Despite the unusual mineralogy and other features of these flows, their bulk chemistry is not very different from that of the more typical hornblende-bearing mafic flow in the same area. Such flows occur interlayered with the hornblende-bearing flows in approximately equal proportions.

The part of this cross-section around Moosetegon Lake is made up of the typical hornblende-bearing mafic flows, both pillowed and massive. A few variolite units were found but most were fine-grained and equigranular. Coarser granoblastic textured flows become more common as the contact with the main mass of the North Bamaji Lake Intrusion (*see* Felsic to Intermediate Intrusive Rocks) is approached.

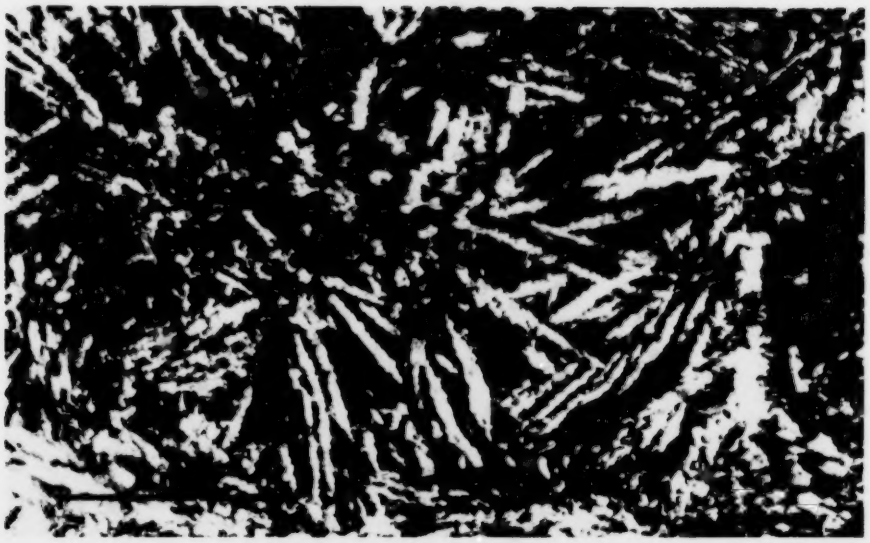

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Photo 1–Photomicrograph (crossed polarizers) of skeletal actinolite blades forming a quench texture similar to microspinifex in a basaltic flow from Rockmere Lake.

SLATE FALLS SECTION (G-H)

Rocks in this section are on both limbs of the Rockmere-Wesleyan Lake Syncline. The sequence is made up almost entirely of mafic metavolcanics and innumerable minor trondhjemitic to granodioritic porphyry intrusions. Contacts between the metavolcanics and granitoid rocks are typically sharp but the porphyry bodies can be rich in amphibolite inclusions. Most of the mafic rocks are very fine grained, granoblastic, highly fissile dark green metabasalts. Generally primary features are not discernible, but some pillowed outcrops are still recognizeable. Distortion due to flattening and shearing has in nearly all cases rendered these useless as top indicators. Ellipsoidal quartz-filled amygdules appear to be quite common but in some cases these can be confused with numerous distended and boudinaged veinlets of quartz.

Layering in some mafic units may be attributable to the shearing of coarse fragmental material or originally bedded tuffaceous rocks. In a few localities gneissic, relatively coarse-grained amphibolite in close proximity to the typical very fine grained fissile metabasalt is likely intrusive in origin.

SOUTH BAMAJI LAKE SECTION (I-J)

This very short section includes the contact between rocks of the upper metavolcanic sequence described in the Northern Fry Lake Section, and much younger metavolcanics exposed along the northern shore of Bamaji Lake. The stratigraphy is correlative with that described in the Fry Lake-Bamaji Section. Near the South Bamaji Lake Section rocks of the older metavolcanic sequence have largely been obliterated by intrusive rocks of the North Bamaji Lake Intrusion. What remains is very similar to the upper part of the Northern Fry Lake Section, consisting mostly of medium-grained massive and pillowed mafic flows. Conglomeratic and sandstone sequences unconformably overlie these flows and the North Bamaji Lake Intrusion. Stratigraphically above the metasediments, which mark a significant break in volcanic activity is a sequence of metavolcanics not more than 200 m thick. Most of this younger sequence consists of cataclastically deformed intermediate to felsic pyroclastic rocks, but the lower units are mafic amphibolites.

These mafic units are thin, and appear to form a discontinuous layer between the metasediments below and pyroclastic rocks above. Most are coarse-grained and gneissic but pillows and fragments are discernible in a few places near the outlet of the Cat River into Bamaji Lake. Layering in these rocks due to differences in grain size and hornblende content between layers, and pronounced schistosity in many examples can be ascribed to differential shearing in the Bamaji Lake Fault Zone.

KAGINOT LAKE SECTION (K-L)

This section includes a mixed sequence of mafic to intermediate flows and intermediate to felsic pyroclastic units on both sides of the Fry Lake Anticline. Through much of the section the more felsic and more mafic units are randomly intercalated but in some parts intermediate to felsic pyroclastic rocks predominate virtually to the exclusion of mafic flows. Mafic rocks, mostly massive aphanitic flows and massive and layered amphibolite units are the dominant lithologies along the northwestern shore of the west arm of Kaginot Lake, on the central part of its main peninsula, and along the northwestern side of the lake. Few pillows were recognized along the section except along the northeastern shore of Kaginot Lake. Both massive and pillowed flows are commonly amygdaloidal and many massive units are plagioclase-phyric.

Along the western arm of Kaginot Lake near the contact with granitoid rocks to the north and west, aphanitic flows are highly fissile and have few primary features preserved similar to the mafic rocks in the Slate Falls Section. Coarse-grained amphibolites in this part of the Kaginot Lake Section are porphyroblastic and/or blasto-ophitic in texture.

Mafic pyroclastic units consisting of thinly bedded black, biotite-rich tuff occur intercalated with light grey dacitic crystal and lithic tuffs in several places around the southern part of Kaginot Lake, but they are volumetrically insignificant.

PETROGRAPHIC SUMMARY OF MAFIC TO INTERMEDIATE METAVOLCANICS

Petrographically, all mafic to intermediate metavolcanic rocks examined from the map area have mineral assemblages consisting of either:

(1) hornblende + plagioclase (An_{35-55}) + quartz ± epidote ± biotite ± chlorite ± garnet

or

(2) actinolite + tremolite + quartz + carbonate + epidote ± chlorite ± biotite

Sphene and Fe-Ti oxides are ubiquitous accessory minerals.

The first assemblage appears to be by far the more common. Actinolite-tremolite-bearing rocks were found to contain no plagioclase, but invariably had substantial carbonate which suggests that they were formed by metasomatic alteration or by metamorphism under high PCO_2 (Klein 1973).

Texturally the hornblende-bearing rocks tend to be granoblastic, blasto-ophitic or porphyroblastic with stubby subhedral hornblende grains forming over 50 percent of most thin sections. In the actinolite-tremolite-bearing rocks however the amphiboles form feathery sheaves and felted masses with rare subhedral porphyroblasts.

Too few thin sections were available to establish a clear pattern regarding the distribution of the two mineral assemblages. Most of the rocks consisting of assemblage (2) were found in the central part of the area around southern Fry and Rockmere Lakes.

Felsic to Intermediate Metavolcanics

Felsic to intermediate metavolcanics ranging in composition from andesite to rhyolite (*see* Petrochemistry of Metavolcanics) underlie about 3 percent of the map area. Nearly all of these rocks are fragmental, and probably pyroclastic in origin. For the most part they are aphanitic, making accurate colour index determinations in the field difficult. Composition can be estimated on the basis of a combination of colour, hardness and phenocryst types present. Many of the pyroclastic units are heterolithic or contain very high proportions of plagioclase crystals and crystal fragments, such that classification based on average mineral and/or chemical composition is of limited value.

Most of the felsic to intermediate pyroclastic rocks occur around the northern part of Fry Lake in a number of east-west-trending relatively thin units interleaved with mafic flows. A few intermediate flows are also found along the western arm of Fry Lake. Pyroclastic units similar to and probably correlative with the Fry Lake rocks occur interlayered with mafic metavolcanics in the Kaginot Lake area. Apparent thickening of the pyroclastic wedges in the southern part of Kaginot Lake may represent a minor volcanic centre.

The other notable occurrence of felsic to intermediate rocks is along the northern shore of Bamaji Lake where there is a thin sequence of intermediate pyroclastic units which has undergone intense cataclastic deformation. This sequence is separated by an erosional unconformity and a metasedimentary wedge from the underlying mafic metavolcanics to the north.

As with the mafic to intermediate metavolcanics these rocks will be discussed below according to their relationships in the sections shown in Figure 2.

A petrographic summary of all of the felsic to intermediate rocks in the area is made separately at the end of this section.

NORTHERN FRY LAKE SECTION (A-B)

Intermediate and felsic pyroclastic units and a few intermediate flows occur on both limbs of the Fry Lake Anticline. In the northern limb these rocks form three sequences, 150 to 400 m thick, which are interlayered with mafic sequences of comparable thickness. In the southern limb however, the intermediate and felsic pyroclastic units and intermediate flows are intimately intercalated with mafic flows and rare pyroclastic units.

Just north of Fry Lake intermediate pyroclastic rocks are interlayered with clastic metasediments. This occurs on both a fine scale along the lakeshore where thin (0.3 to 5 m) dacitic lithic tuffs are intercalated with phyllitic mudstone units and, on a large scale between Fry Lake and the Obaskaka Lake Pluton where major conglomeratic lenses intertongue with the pyroclastic wedges.

Most of the rocks discussed in this section are andesitic and dacitic in composition (*see* Petrochemistry of Metavolcanics). The notable exception is the sequence of pyroclastic units which occurs along the northern side of the long east-west bay west of the main body of Fry Lake. The rocks in this sequence are rhyodacitic to rhyolitic, white weathering, lapilli-tuff to tuff-breccia. Most of the units appear to be monolithic, consisting of highly siliceous angular bombs and blocks in a tuffaceous matrix of similar composition rich in plagioclase crystals. Some crystal tuff, lapilli-tuff, and lapillistone units are quite thick (10 m) and massive with no apparent bedding. However, in other outcrops tightly folded bedding and highly contorted fragments are obvious, and indicate minor fold axes subparallel to the axis of the Fry Lake Anticline which passes nearby. Significantly, these siliceous metavolcanics occur in close proximity to sulphidic chemical metasediments and the conglomeratic units which may indicate the presence of a volcanic center in the vicinity. Pumiceous fragments are rare in these units which appear to be the products of fall-back type pyroclastic eruptions.

Rhyodacitic lithic and crystal tuff units occur in a few places in eastern and central Fry Lake, but they are minor components in predominantly andesitic to dacitic sequences. The most common rock type is grey weathering, essentially monolithic lapilli-tuff consisting of subangular very fine grained andesitic feldspar porphyry fragments in a fine matrix similar in composition to the lapilli but with highly variable concentrations of white equant plagioclase crystals 2 to 4 mm across. Again few pumiceous fragments are recognizeable and a fall-back origin is postulated for these units. These rocks grade with increasing lapilli content with lapillistone and with increasing fragment size into tuff-breccia which is locally quite common. Bedding is generally distinct, and fragment size gradation within units is common. In some monolithic units, fragments are difficult to discern but typically preferential weathering of the softer

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Photo 2–Andesitic lapillistone unit in contact with a massive basaltic flow on a small island in the main body of Fry Lake.

tuffaceous matrix enhances colour and textural contrasts between fragments and matrix (Photo 2). In thinly bedded lithic tuff and lithic-crystal tuff units exposed along the northern shore of Fry Lake, sedimentary structures are well preserved. These are predominantly waterlain fall-out type deposits. Top determinations can be made in some instances based on a combination of grain size gradation, scour channels and load casts.

Heterolithic pyroclastic units are less common than the essentially monolithic rocks described above. The most notable examples of heterolithic beds are on the islands in the northeastern part of Fry Lake, where there are sequences of well-bedded, crudely graded units of lithic tuff to tuff-breccia. Commonly three types of lithic fragments are abundant in these rocks. One type is massive

to slightly plagioclase phyric, light grey porcellaneous dacite. A second consists of plagioclase-rich grey-green andesite, and the third is massive fine-grained basaltic amphibolite. The first two types are most abundant and generally largest in terms of fragment size. The matrix is a medium to dark grey crystal-lithic tuff similar to that of the monolithic beds with which these heterolithic units are commonly intercalated. Similar heterolithic units are exposed along the bays of western Fry Lake, but there, such units are relatively thin. The lack of pumiceous material and the heterolithic nature of these units point to a highly explosive fall-back origin for these units.

Andesitic pillowed flows are uncommon but do occur in a few places along the northern bays north of the long western arm of Fry Lake. They are intercalated with basaltic flows and intermediate pyroclastic units. Pillows in the andesitic flows are generally well-packed and relatively small (10 to 30 cm long) with thin black selvages (<1 cm thick).

KAGINOT LAKE SECTION (K-L)

The felsic to intermediate pyroclastic sequences which parallel Kaginot Lake are similar to those around Fry Lake with which they are probably correlative. These rocks form three main sequences and also occur as minor intercalations between mafic flows. Nearly all of the pyroclastic units are essentially monolithic, and most are andesitic in composition. The most common rock-types are lithic-crystal tuff, and lapilli-tuff to tuff-breccia with lithic-crystal tuff matrices. This matrix material contains between 10 and 40 percent equant white plagioclase crystals, and is characterized by whispy chlorite-rich lenses, up to 1 cm long, interstitial to the lithic fragments. Lapilli- and bomb-sized fragments are of similar composition to the matrix but generally weather lighter in colour and have a lower crystal content. Bedding is obvious in most places, with lithic fragment size and crystal content variations within individual beds and between adjacent units. Thinly bedded, interbedded lithic and crystal tuff with a wide range in composition occur along the eastern side of the central peninsula of Kaginot Lake. Dark green chloritic beds appear to be basaltic. Pale green plagioclase-rich units similar to those discussed above are andesitic, and light grey plagioclase and quartz-bearing units in which pumiceous lapilli-sized fragments are recognizable are rhyodacitic to dacitic. Pumice forms up to 15 percent of some of these units. They may represent distal ash flow-type deposits, and the coarser breccias may be more proximal products of this type of eruption.

SOUTH BAMAJI LAKE SECTION (I-J)

Intermediate pyroclastic rocks, mostly dacitic in composition make up the bulk of the metavolcanic sequence exposed along nearly the entire length of the north shore of Bamaji Lake. Due to their proximity to the Bamaji Lake Fault Zone these rocks are highly sheared and cataclastically deformed. Tephra are

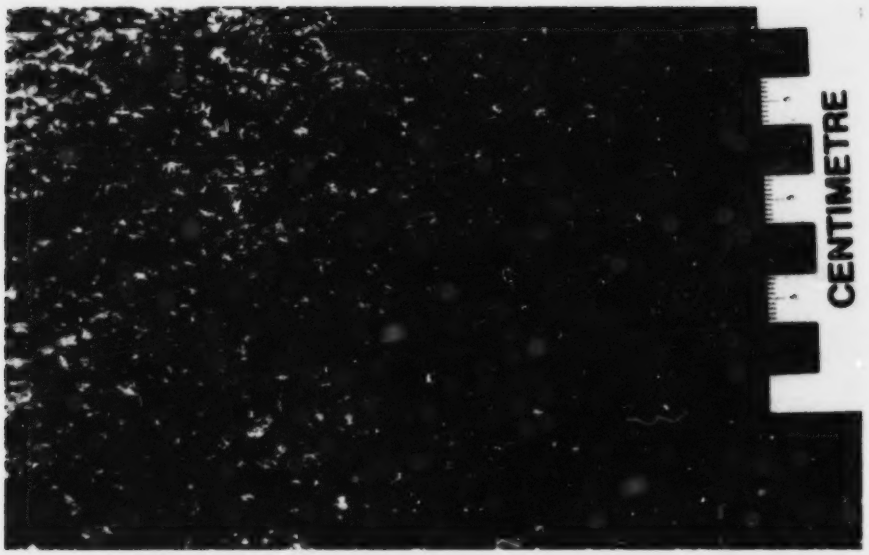

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Photo 3–Coarse massively bedded crystal-lithic tuff from the northern side of Bamaji Lake south of Moosetegon Lake.

highly deformed with axial ratios ranging from 5:1 to 20:1. Pseudotachylite was observed intruding these rocks in several localities in the northeastern part of the lake. Despite this the fragmental nature of the pyroclastic units is generally discernible except in the extreme southern part of the area. There, cataclasis and recrystallization plus introduction of secondary quartz have obliterated primary features, and in many outcrops it is difficult to distinguish between the intermediate pyroclastic rocks and trondhjemite rocks of the North Bamaji Lake Intrusion which have been similarly affected.

Mafic flows and pyroclastic units occur interlayered with the more felsic pyroclastic beds particularly near the base of this sequence which is altogether only 150 to 250 m thick. Both mafic and more felsic units are generally thin, from less than 1 metre to a maximum of 10 m, and bedding is obvious. The most common rock-types are dacitic to andesitic lapilli-tuff, lapillistone and crystal-lithic tuff (Photo 3). Most beds are monolithic, but these are interbedded with many heterolithic units. Dacitic to rhyodacitic lithic tuff units only a few centimetres thick commonly occur interbedded with the coarser pyroclastic material, and in some places themselves form accumulations up to 20 m thick. Rocks as coarse as tuff-breccia occur in only a few places along the Bamaji Lake shoreline as minor variants in relatively thick lapilli-tuff units.

Thinly bedded rhyodacitic crystall tuff units containing large (2 to 4 mm) round quartz crystals and small plagioclase grains occur in a highly contorted

sequence exposed for several hundred metres along the Bamaji Lake shore, south of the northeast end of Moosetegon Lake. The beds are highly folded on a scale of centimetres to several metres, and crenulated on a much finer scale. Lapillistone and tuff-breccia which have tuffaceous matrices rich in both quartz and plagioclase crystals occur nearby and are also highly contorted. The rocks appear to have been affected by a northeast-trending fault which intersects the major Bamaji Lake Fault Zone in this vicinity

In general, it is doubtful whether pumiceous material would be recognized in this highly sheared sequence. The fine bedding in many units and the heterolithic nature of others tend to indicate an airfall origin for these rocks but most features critical for their genetic classification have been destroyed by cataclasis.

FRY-BAMAJI LAKE SECTION (C-D)

East of the Fry-Bamaji Lake falls the metavolcanic sequence exposed along the Bamaji Lake shore consists of intimately intercalated intermediate and mafic pyroclastic units in roughly equal proportions. In this area the intermediate rocks are mostly monolithic andesitic lapilli-tuffs which contain coarse hornblende, and which differ from the more mafic rocks only in their lower ferromagnesian mineral content. Toward the southwest, mafic pyroclastic units become less abundant, and the intermediate pyroclastic rocks are fine-grained to aphanitic and porcellaneous.

PETROGRAPHY OF FELSIC TO INTERMEDIATE METAVOLCANICS

Mineral assemblages found in the felsic to intermediate rocks studied from this area can be summarized as follows:

(1) quartz + plagioclase + muscovite + biotite + epidote ± chlorite ± carbonate,

(2) quartz + plagioclase + actinolite + epidote + carbonate ± chlorite ± biotite,

(3) quartz + plagioclase + hornblende + epidote ± chlorite ± biotite,

(4) quartz + plagioclase + muscovite + chloritoid ± chlorite.

Assemblage (1) is by far the most commonly encountered, and most of the rocks have apatite, magnetite and tourmaline as abundant accessories.

Primary features are readily recognized in thin sections of rocks from the Fry Lake and Kaginot Lake areas. In many examples ash- and lapilli-sized lithic fragments are clearly distinguishable, and are bent, broken, or cracked; also, well-zoned plagioclase crystals typical of pyroclastic rocks are common. Seriate and porphyritic textures can be seen in lithic fragments in many rocks, and textural differences between fragments in heterolithic units are generally well-preserved. In thin sections from some intermediate flows pilotaxitic align-

ment of plagioclase is well-developed. Phyllosilicate foliations in pyroclastic rocks are strong and parallel the flattening of lithic fragments forming envelopes around them. Crenulation of the phyllosilicate foliation to form weak cleavages is particularly noticable around the southern part of Kaginot Lake.

In thin section, pyroclastic rocks from the Bamaji Lake sequence exhibit textures typical of highly sheared and cataclastized rocks. The quartzofeldspathic material either displays protomylonitic and mortar textures, or has undergone such extensive recrystallization that all original and cataclastically induced features have been destroyed leaving an even textured blastomylonite (Spry 1969). Phyllosilicate foliations are very strong in all of these rocks. Crenulation cleavages or microfolds are also common. In a few examples, nebulous outlines of what appear to be felsic lapilli are visible because of slight differences in grain size, texture and phyllosilicate mineral content, but these can easily be confused with lenses of secondary quartz.

Petrochemistry of Metavolcanics

Figure 2 shows the locations at which metavolcanic samples were collected for whole rock chemical analyses. The analyses, which were provided by the Geoscience Laboratories, Ontario Geological Survey, Toronto, were done: (a) to check rock classifications made in the field based on colour index, (b) to characterize the metavolcanics in terms of their chemical affinities, and (c) to aid in stratigraphic correlation both along strike and across major structural axes. Table 2 lists a number of the chemical analyses obtained for this report.

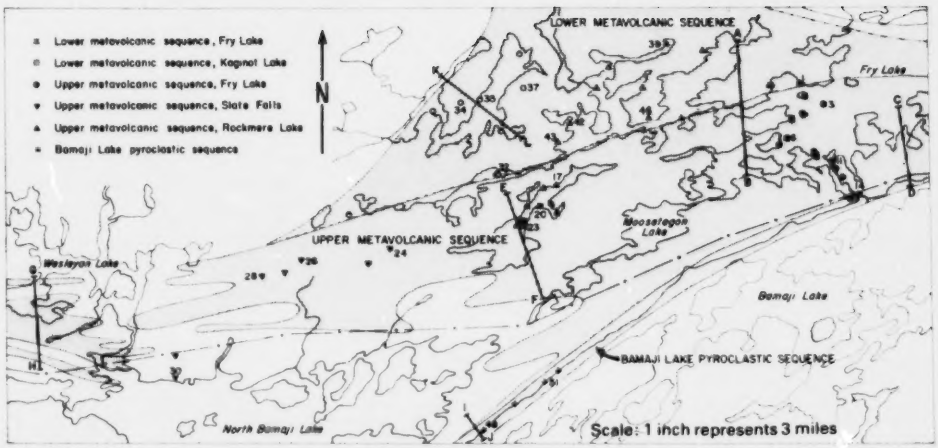
In Figure 3 the Slate Falls analyses are displayed on several plots commonly applied to volcanic rock data. Using the chemical criteria provided by these plots the following general observations can be made:

(1) The metavolcanics in this area were laid down in three distinct volcanic cycles. The oldest of these, the mixed sequence of mafic to intermediate flows and intermediate to felsic pyroclastic units exposed around Northern Fry Lake and Kaginot Lake (lower metavolcanic sequence in Figure 3) is almost entirely calc-alkaline (*see* Figures 3b, 3d, 3e), and is characterized by potassium-poor andesitic and dacitic rocks (Figure 3f). The thick succession of mafic flows which overlies the mixed sequence consists entirely of "average" tholeiitic basalts (upper metavolcanic sequence in Figure 3). The much younger intermediate pyroclastic rocks exposed along the north shore of Bamaji Lake are made up of potassium-rich (Figure 3f) calc-alkaline dacitic rocks (Figures 3b, 3d, 3e).

(2) In the vast majority of cases the classification of the rocks made in the field were confirmed by the chemical analyses.

(3) The most felsic rock analysed was a sodic dacite from the relatively thick sequence of pyroclastic units which occurs along the northern side of the long east-west bay of northwestern Fry Lake. Rocks of the Bamaji Lake pyroclastic sequence are also dacitic in composition but contain over 5 times as much K_2O.

(4) Despite the unusual mineralogy of the Rockmere Lake metavolcanics, petrochemically they are indistinguishable from the tholeiitic sequence of southern Fry Lake. The correlation of mafic rocks in these two areas and those north



SMC 15196

Figure 2–Sketch map of the Slate Falls Area showing locations of chemically analyzed metavolcanic rock samples and cross-sections described in the text. Location numbers correspond to those used in Table 2. Named sequences are referred to in General Geology, and Stratigraphy sections.

of North Bamaji Lake is reinforced by the chemical data.

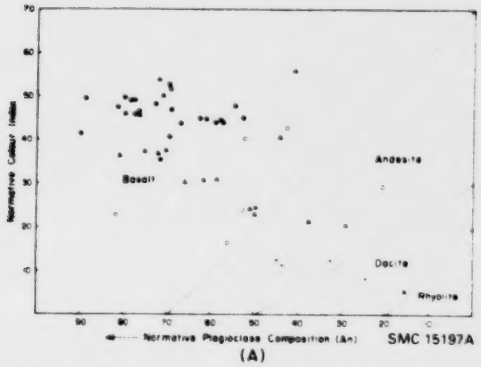
(5) Rocks in the Kaginot Lake area show a wide dispersal on most plots, possibly indicating the existence of a discrete highly differentiated volcanic centre in that area.

METASEDIMENTS

Clastic Metasediments

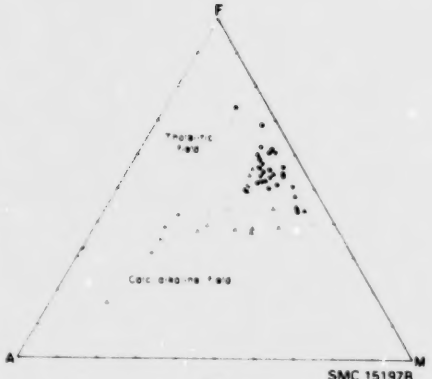
Clastic metasediments underlie only about two percent of the area discussed in this report. Most of these rocks occur in one of three major epiclastic sequences. The first formed, the Fry Lake sequence, consists of metawacke-mudstone and conglomeratic units which overlie and in part interdigitate with metavolcanics on the north side of Fry Lake. The second is exposed along the northern side of the islands in Bamaji Lake and consists almost exclusively of metawacke beds. The third and least extensive sequence occurs discontinuously along the northern side of Bamaji Lake and is made up mostly of conglomeratic and pebbly sandstone units.

Slate Falls Area



SMC 15197A

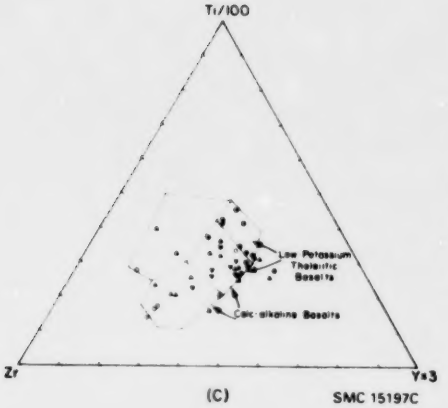
(A)



SMC 15197B

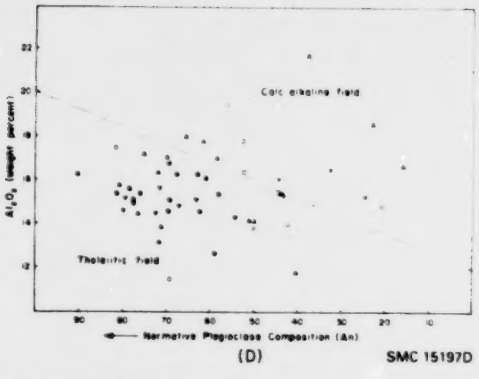
(B)

- Lower metavolcanic sequence, Fry Lake
- Lower metavolcanic sequence, Kaginot Lake
- Upper metavolcanic sequence, Fry Lake
- Upper metavolcanic sequence, Slate Falls
- Upper metavolcanic sequence, Rockmore Lake
- Bamaji Lake pyroclastic sequence



(C)

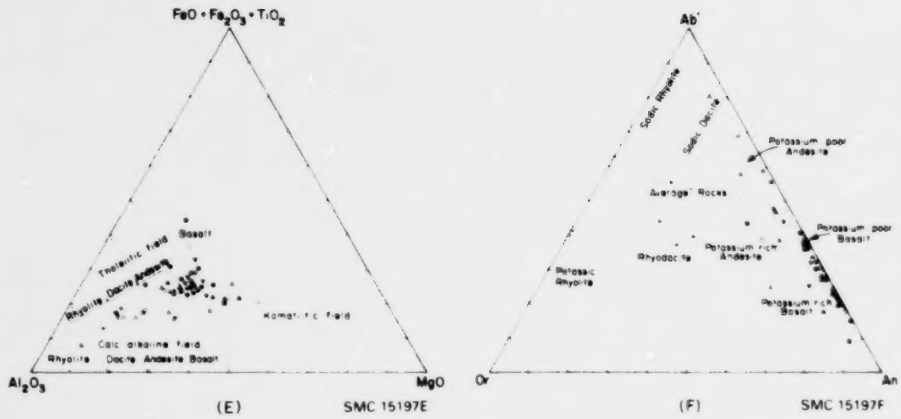
SMC 15197C



(D)

SMC 15197D

- Lower metavolcanic sequence, Fry Lake
- Lower metavolcanic sequence, Kaginot Lake
- Upper metavolcanic sequence, Fry Lake
- Upper metavolcanic sequence, Slate Falls
- Upper metavolcanic sequence, Rockmore Lake
- Bamaji Lake pyroclastic sequence



- Lower metavolcanic sequence, Fry Lake
- Lower metavolcanic sequence, Kaginot Lake
- Upper metavolcanic sequence, Fry Lake
- Upper metavolcanic sequence, Slate Falls
- Upper metavolcanic sequence, Rockmere Lake
- Bamaji Lake pyroclastic sequence

Figure 3–Petrochemistry of metavolcanics from the Slate Falls Area displayed in:
(A) plot of Normative Colour Index versus Normative Plagioclase Composition (Irvine and Baragar 1971),
(B) standard AFM plot,
(C) plot of Ti(x10^{-2})-Zr-Y(x3) (Pearce and Cann 1973),
(D) plot of Normative Plagioclase Composition versus weight percent Al_2O_3 (Irvine and Baragar 1971),
(E) Jensen Cation Plot (1976), and
(F) plot of Normative Or-An-(Ab + 5/3Ne) (Irvine and Baragar 1971).

FRY LAKE SEQUENCE

The main part of this sequence between the northern side of Fry Lake and the Obaskaka Lake Pluton has a maximum thickness in this area of about 700 m. It thickens toward the northwest and Burley Lake, and eastward toward Billet Lake (Sage *et al.* 1973), which are outside the map area. Within the map area most of the sequence consists of monotonously interbedded metawacke and mudstone units which are generally thickly laminated to thinly bedded (Photo 4). The metawacke beds are mostly massive, but well-developed grading occurs in some units. This, along with rare truncated cross-bedding, and load casts, give dependable stratigraphic facing determinations.

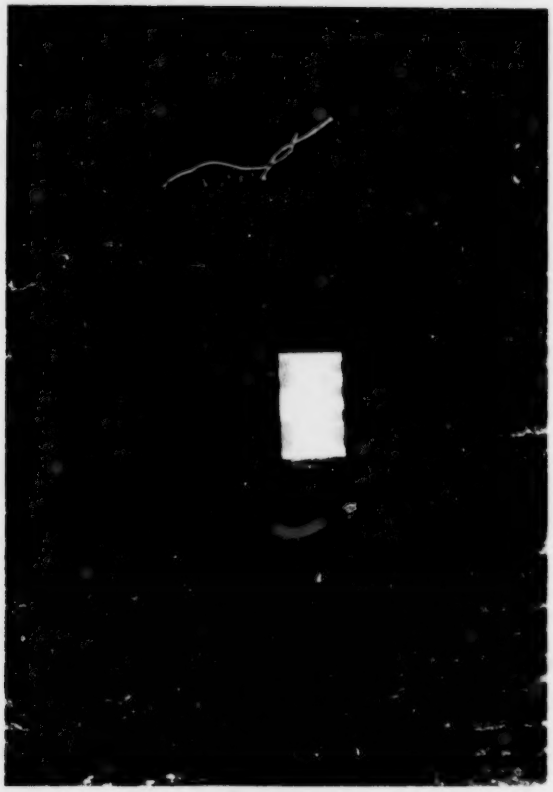
TABLE 2: PARTIAL CHEMICAL ANALYSES OF METAVOLCANIC ROCKS FROM THE SLATE FALLS AREA. MAP REFERENCE NUMBERS ARE THOSE USED IN FIGURE 2. ANALYSES DONE BY THE GEOSCIENCE LABORATORIES, ONTARIO GEOLOGICAL SURVEY, TORONTO.

MAP REF. NO.	1	3	6	11	14	17	20	23	24	26	28
SAMPLE NO.	78HW Z50-23	78HW Z50-26	78HW Z50-15	78HW Z50-07	78HW Z50-02	78HW 38-10	78HW C8-09	78HW 38-4	78HW Z9-05	78HW Z19-04	78HW Z48-02
SiO_2	49.71	49.5	47.6	47.8	46.3	51.0	50.9	51.8	48.6	47.4	53.0
Al_2O_3	12.2	14.9	14.9	14.0	15.9	15.9	13.3	14.0	14.8	14.1	15.3
Fe_2O_3	19.9	11.9	11.6	10.3	13.1	11.4	10.3	10.6	14.1	15.7	9.78
FeO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MgO	4.30	7.15	7.81	10.5	6.93	5.28	10.0	9.08	7.18	6.67	5.98
CaO	7.40	10.3	12.7	11.5	12.6	11.1	10.1	9.82	10.9	11.1	11.0
Na_2O	1.91	2.35	1.09	1.53	2.18	1.57	1.35	1.13	1.01	1.31	1.53
K_2O	0.05	0.43	0.01	0.01	0.14	0.08	0.08	0.07	0.09	0.44	0.07
TiO_2	1.98	0.83	0.70	0.53	1.06	1.04	0.55	0.58	1.11	1.24	1.15
P_2O_5	0.14	0.08	0.07	0.06	0.10	0.09	0.07	0.09	0.10	0.10	0.11
S	0.14	0.06	0.02	0.03	0.08	0.15	0.01	0.02	0.15	0.33	0.17
MnO	0.26	0.23	0.20	0.17	0.20	0.22	0.17	0.18	0.23	0.24	0.28
CO_2	0.23	0.81	0.71	0.90	0.80	0.39	0.36	0.23	0.11	0.24	0.68
Total	98.2	98.5	97.4	97.3	99.4	98.2	97.2	97.6	98.4	98.9	99.0
Specific Gravity	3.00	3.00	3.02	3.00	3.05	3.01	2.94	2.93	3.05	3.04	2.95
Cu	1452	110	105	110	120	135	85	60	120	175	115
Pb	10	10	10	10	10	10	10	15	10	10	10
Zn	150	95	80	65	100	125	70	100	110	135	160
Cr	15	490	600	910	375	400	780	600	400	105	450
Ni	20	110	100	160	165	95	110	95	80	60	95
Co	50	55	50	50	50	45	40	45	45	45	50
Ba	30	70	40	50	60	70	70	90	60	190	60
Sr	140	80	200	150	160	100	130	160	110	150	130
Rb	10	10	10	10	10	10	10	10	10	10	10
Y	30	30	20	20	30	30	20	20	30	30	30
Zr	110	40	30	10	60	50	40	40	100	100	70
Li	10	8	8	8	10	10	10	10	8	15	8

TABLE 2 | Continued

MAP REF. NO.	30	32	34	35	37	39	42	43	46	49	51
SAMPLE NO.	78HW 68-01	78HW S53-04	78HW Z10-08	78HW Z7-05	78HW 56-01	78HW 34-3	78HW S54-03	78HW S54-01	78HW S41-02	78HW Z47-03	78HW Z47-07
SiO_2	49.0	63.3	53.5	57.0	49.3	68.6	62.9	62.6	51.9	66.7	63.9
Al_2O_3	14.0	13.5	10.9	17.0	13.5	16.4	13.8	13.8	20.8	15.3	16.1
Fe_2O_3	12.8	5.90	10.1	7.31	17.9	1.85	5.70	5.69	7.27	5.43	5.37
FeO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MgO	7.73	5.02	12.6	1.75	5.73	1.45	5.56	5.54	4.73	2.27	2.54
CaO	11.4	5.94	6.09	13.0	6.27	2.41	6.05	6.04	5.12	3.53	2.77
Na_2O	2.47	2.49	1.21	1.04	3.06	6.43	2.65	2.73	4.59	2.32	2.91
K_2O	0.26	1.13	0.01	0.02	1.02	0.51	0.33	0.33	0.86	3.21	3.51
TiO_2	0.77	0.55	0.55	0.62	0.90	0.55	0.36	0.37	0.56	0.54	0.54
P_2O_5	0.08	0.10	0.09	0.13	0.11	0.15	0.10	0.10	0.14	0.23	0.20
S	0.02	0.04	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.24	0.09
MnO	0.21	0.10	0.15	0.10	0.24	0.05	0.09	0.09	0.09	0.09	0.08
CO_2	0.27	0.17	0.75	0.42	0.39	0.60	1.10	0.39	0.98	0.26	0.21
Total	99.0	98.2	96.0	98.4	98.4	99.0	98.7	97.7	97.0	100.1	98.2
Specific Gravity	3.04	2.78	2.81	2.96	2.90	2.66	2.79	2.87	2.8	2.74	2.72
Cu	90	20	6	90	170	25	70	90	25	70	50
Pb	10	15	10	10	10	10	10	10	10	25	10
Zn	100	60	70	45	145	40	55	85	55	70	45
Cr	430	160	1260	30	9	90	550	155	170	135	145
Ni	100	85	350	25	20	20	160	25	90	50	45
Co	50	20	50	20	60	10	25	20	25	20	20
Ba	60	340	40	60	370	170	90	40	180	810	940
Sr	110	250	150	380	330	550	250	280	370	710	630
Rb	10	40	10	10	30	10	10	10	30	110	90
Y	20	30	20	20	30	10	10	20	10	20	20
Zr	50	90	60	130	60	120	80	110	60	120	160
Li	10	9	15	4	25	8	10	10	15	45	20

Notes:
1) Analyses for oxide constituents given in weight percent.
2) Trace element concentrations given in ppm.



OGS 10 647

Photo 4–Rhythmically bedded metawacke-mudstone sequence from the extreme northeast corner of the Slate Falls map area (tops face upward).

Thin intercalations of lithic tuff ranging in composition from intermediate to felsic, are common in some outcrops, but make up only a very small part of the total sequence.

The metawacke units are generally white to light grey on the weathered surface, and buff to brown on the fresh surface. As the Obaskaka Lake Pluton is approached, the biotite content of these rocks increases and biotite flakes become coarser. At the same time mudstone beds become increasingly phyllitic. Close to the contact with the pluton the metasediments in some outcrops are migmatitic displaying quartz-feldspar-biotite schist injected by a leucocratic quartz monzonite neosome.

Outcrops of massive feldspathic metawacke with few mudstone intercalations are common. These units are relatively coarse-grained and, where discer-

nible, show medium to thick bedding. In a few exposures, mudstones predominate over the sandstone units in terms of number and total volume, but this is uncommon. Some graphite-rich mudstone beds occur in areas where there are pyroclastic intercalations and in some cases they are associated with thinly laminated white chert.

About 500 m south of, and stratigraphically below the main sequence described above, a second metasedimentary sequence forms a lens about 200 m thick which intertongues with the surrounding intermediate to felsic pyroclastic rocks. The lower sequence is almost entirely polymictic clast-supported cobble and pebble conglomerate in places intercalated with minor pebbly sandstone beds. Bedding is impossible to discern except where these finer units occur. In most places clasts are extremely flattened making the clast-types, their relative abundances, and the clast-matrix relationships very difficult to map. The less competent clast-types commonly exhibit axial ratios of 20:1 and greater, whereas those for quartz and some granitoid clasts are on the order of 3:1.

Aphanitic intermediate metavolcanic clasts are most abundant, constituting up to 85 percent of the clast population. Cobbles and pebbles of mafic amphibolite are generally second in importance at 10 to 25 percent. Vein quartz clasts make up 1 to 2 percent of the total; and, although clasts of white and black chert, and quartz-magnetite ironstone form less than one percent of most exposures, they are ubiquitous. Granitoid clasts are rare. In some exposures in the western part of the sequence coarse amphibolite (possibly metagabbro) clasts are abundant, forming up to 50 percent of the clast population.

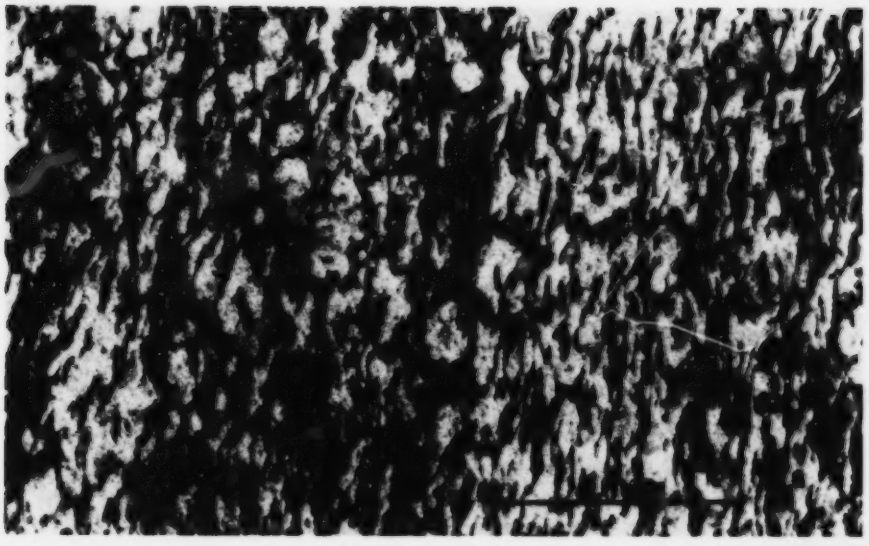
Most clast types weather low relative to the matrix material which is a dark grey to black biotite and/or chlorite-rich schistose metawacke commonly containing small almandine euhedra.

BAMAJI LAKE SANDSTONE SEQUENCE

The northern edges of the large islands in Bamaji Lake are underlain by thinly bedded metawacke units, which are now quartz-feldspar-biotite schists. This sequence continues eastward out of the map area, and appears to thicken in that direction. To the southwest the metasediments extend for a short distance outside the map area where they are said to terminate in a migmatized zone within the Bamaji Blackstone Batholith (Sage and Breaks 1976).

Along most of its length, the contact between these metasediments and the granitoid rocks to the south occurs across a narrow (<100 m) hybrid zone in which "rafts" and continuous units of quartz-feldspar-biotite schist are intruded and engulfed by very inhomogeneous, commonly porphyroblastic biotite-rich diorite to granodiorite. To the east, on the mainland, this contact zone widens, and porphyritic trondhjemite to granodiorite sills, mostly 0.5 to 2 m wide, intrude the metasediments for several hundred metres north of the contact. These are thicker and more numerous as the contact is approached. Still further east as the metasedimentary sequence continues to broaden, the contact relationships become blurred by migmatization.

To the north, the metasediments are bounded by the Bamaji Lake Fault



OGS 10 648

Photo 5–Photomicrograph (plane polarized light) of protomylonitized metawacke from the northern side of the largest island in Bamaji Lake.

Zone which separates this sequence from felsic to intermediate metavolcanics exposed along the northern shore. The original stratigraphic relationship between rocks on the northern and southern sides of the fault is not known. The metavolcanics face southward, but indications of stratigraphic tops are absent or unreliable in the metasediment because of metamorphic effects.

Original textures and sedimentary structures other than bedding are rarely preserved in these rocks. They are now granoblastic to schistose, and a few units are highly porphyroblastic. Some units closest to the Bamaji Lake Fault Zone are protomylonitic (Photo 5). On weathered surface they vary considerably. Some outcrops are black to medium grey and weather with very irregular or smooth undulating surfaces. These rocks, which are generally granoblastic and biotite-rich, resemble intermediate tuffs, and indeed some may be tuffaceous, but they are in several places intercalated with, and/or are gradational into dark to light brown-weathering relatively biotite poor units which are undoubtedly metasedimentary. The dark grey units were probably derived from lithic wackes, while the brown-weathering beds likely had more arkosic progenitors. The lighter coloured beds are generally very even and relatively coarse grained, which gives rise to a very gritty weathered surface. They are also typically quite fissile.

Lensoidal porphyroblasts of andalusite up to 2 cm long occur in a few of the dark grey units exposed along the shoreline near the eastern end of Bamaji

Lake. In some units the porphyroblasts constitute 20 percent of the rock. Small euhedral almandine porphyroblasts occur sparsely disseminated in both the dark grey metawackes and the brown-weathering beds.

Intercalated with the schists in a few places along the northern side of the largest island in Bamaji Lake are units of banded, white metachert which grade into weak quartz-magnetite ironstone commonly bearing up to 5 percent pyrite. These units are generally quite thin (2-5 cm), but appear to be continuous for considerable distances. In some of the same outcrops as these chemical metasediments are found, there are also beds of fine white-weathering dacitic lithic tuff, but these are rare.

BAMAJI LAKE CONGLOMERATIC SEQUENCE

This sequence is well-exposed along two parts of Bamaji Lake's northern shore. From the outlet of North Bamaji Lake into Bamaji Lake the sequence extends for at least 5 km along the shore with a maximum thickness of about 250 m. The second major area of exposure is around the Fry-Bamaji Lake falls. In both of these occurrences the conglomerates are located above mafic metavolcanics and beneath intermediate pyroclastic rocks or mixed intermediate and mafic sequences. A few minor occurrences of pebble conglomerate and coarse sandstone were found just north of Bamaji Lake between the two main areas outlined above. These appeared to be in the same stratigraphic position, but are thin and discontinuous and too small to be shown individually on the accompanying map.

The metasediments near the Fry-Bamaji Lake falls have been cataclastically deformed. Most of the rocks are polymictic cobble conglomerates which appear to fine southward (upward stratigraphically) into pebble conglomerates. Clasts are not only flattened, but many are folded and contorted such that less competent clast types actually wrap around other fragments. Most units appear to be clast supported but in most outcrops the clast-matrix relationship is difficult to assess. Bedding is rarely discernible, except where thin (< 0.5 m) units of coarse sandstone were observed between conglomerate beds. Sorting in terms of clast size is poor in most units.

A large number of distinct clast types are present. The most abundant types are a variety of fine- to medium-grained light grey plagioclase-phyric rocks which appear similar to trondhjemitic rocks from the North Bamaji Lake Intrusion and to the numerous minor porphyry intrusions which occur around that body. Some clasts may also be intermediate metavolcanics. Mafic amphibolite fragments constitute between 10 and 30 percent of the clast population, but vein quartz and metasedimentary clasts are rare. Granitoid clasts other than the white-weathering trondhjemite types are absent. The matrix is a light grey to buff medium-grained, commonly phyllitic metawacke.

A succession of pebble conglomerate units only about 25 m thick in total overlies the cobble conglomerate sequence but these are poorly exposed. Above is a sequence of very thinly bedded metawacke-mudstone units which is well-exposed around the small bay around the outlet of Fry Lake. These are still quite fine-grained, but obvious sedimentary structures are difficult to discern,

in part because of numerous quartz veinlets which cut the rock subparallel to bedding. Dark brown irregular pseudotachylite veinlets up to 8 mm wide can be seen following fractures in several outcrops.

The other important occurrence of conglomeratic rocks along the north shore of Bamaji Lake is very similar to that just described. Most of the sequence in the south-central part of the area consists of cobble and pebble conglomerate units commonly interbedded with pebbly and cobbly sandstone beds. Bedding is obvious in most outcrops with beds ranging in thickness from 10 cm to >5 m. A few beds exhibit normal clast size gradation, but commonly pebble and cobble sized fragments occur intimately intermixed. Most of the conglomerates appear to be matrix-supported but there are exceptions. Along strike clast size increases within the map area toward the southwest, with the coarsest cobble and boulder-bearing conglomerates occurring in the vicinity of the outlet of North Bamaji Lake into Bamaji Lake. The degree of clast deformation varies widely both along and across strike, but in most outcrops the clasts form rods with axial ratios in the order of 10:2:1.

The relative proportion of clast types can vary radically from unit to unit. In the majority of beds white weathering, medium-grained trondhjemite clasts are predominant in terms of both abundances and size. Commonly these trondhjemite clasts constitute over 75 percent of the clast population. The rest are mostly mafic amphibolites. Intercalated with such units are beds in which mafic to intermediate metavolcanic clasts are far more abundant, making up 40 to 60 percent of the total. Quartz and fine metasedimentary pebbles are uncommon but do occur in some units. The matrix is dark grey, rich in biotite and quite coarse grained. Commonly coarse sand and granule-sized lithic fragments make up much of this material.

Minor intercalations of fairly coarse, relatively clean sandstone can be seen in some conglomeratic outcrops, but they are much more common toward the northeast where fine pebbly sandstone and sandstone units make up the bulk of this sequence. Most of these rocks are grey-weathering lithic wackes which contrast quite sharply with the arenite beds. On one small island near the north shore of Bamaji Lake thinly bedded, white weathering arenite units exhibit clearly observable graded bedding despite considerable recrystallization.

In at least one place just south of the map area the contact between the conglomeratic rocks and the North Bamaji Lake Intrusion is exposed. The trondhjemite has an irregular erosional surface with up to 0.5 m of relief, which is directly overlain by a massive poorly consolidated rock unit 1 to 2 m thick composed almost exclusively of trondhjemite gravel. The contact appears quite sharp in places but in others it is virtually imperceptible. The gravel tends to fine upward (i.e. southward) and becomes more muscovite-rich in that direction.

Overlying this material which is clearly the weathering product of the underlying trondhjemite, there are several units of biotite-rich schist interlayered with more of the finer trondhjemite gravel. These units are 5 to 10 cm thick and total approximately 50 cm. This mixed sequence is then overlain by the type of pebble and cobble conglomerate units containing a preponderance of trondhjemite clasts which have already been described above.

PETROGRAPHY OF CLASTIC METASEDIMENTS

Petrographic examination of metasediments from all parts of the area show that there are no significant differences in mineralogy from one sequence to another. The mineral assemblages found can be summarized as:

(1) quartz + plagioclase + biotite + muscovite ± chlorite ± epidote ± garnet ± cordierite ± andalusite

or

(2) quartz + plagioclase + biotite ± epidote ± garnet ± chlorite.

Garnet and cordierite were found to be quite common in both the Fry Lake and Bamaji Lake sequences, but andalusite was only recognized in the southern sequence and even there it is uncommon. The only other metamorphic index mineral observed was chloritoid which was seen in some rocks from the Fry Lake metawacke-mudstone sequence. Tourmaline, magnetite, zircon, and apatite are ubiquitous accessory minerals in all of these rocks.

The granoblastic nature of the metasediments from the north side of the islands in Bamaji Lake is readily seen in thin section. Most are very even grained and textured. Lithic fragments are very difficult to discern in most thin sections because of recrystallization. Strong phyllosilicate foliations deflect around relict lithic fragments and tend to preserve something of their shape. Quartz grains tend to be somewhat flattened parallel to the mineral foliation, and appear crushed along grain boundaries. Garnet and muscovite porphyroblasts are generally subhedral but relatively small (<0.5 cm). Cordierite and andalusite on the other hand form large (0.5 to 2 cm), diffuse, anhedral porphyroblastic grains which show extensive alteration to sericite.

The matrices of some rocks from the conglomeratic sequence on the north side of Bamaji Lake exhibit well-developed mortar texture. Others are characterized by long ribbon-like lenses of quartz typical of mylonites (Spry 1969). Still others have been severely recrystallized, giving rise to coarse granoblastic and porphyroblastic textures.

In contrast to the above most of the Fry Lake metasediments exhibit original sedimentary textures. Recrystallization in outcrops near the lake has been minimal. Obvious bimodal grain size distribution of quartz and feldspar which is characteristic of wacke type sandstone (Pettijohn 1975) is well-preserved. Despite this, phyllosilicate foliation is readily apparent in all of these rocks.

To the north, closer to the Obaskaka Lake Pluton, the metasediments have been recrystallized to form even textured granoblastic rocks which commonly contain small garnets.

Chemical Metasediments

Chemical metasediments underlie only a small fraction of this area, and so far they have been found exposed in just three localities.

In northern Fry Lake there is a single exposure of finely laminated quartz-magnetite ironstone and chert on a small island not far from the Flicka Red

Lake Gold Prospect (*see* Economic Geology Section). Anomalies on aeromagnetic maps (ODM 1976a,b,c,d,e,f) strongly suggest that a considerable thickness of magnetite and/or pyrrhotite-bearing units extend for several kilometres to the northeast and northwest. This has been borne out by diamond drilling of the anomalies, the axes of which have been indicated on the accompanying geological map (Map 2482, back pocket). Much weaker anomalies were encountered on traverses just north of Fry Lake's long western arm, but no outcrops of chemical metasediment were found.

The exposure mentioned above is quite small but shows considerable contortion of the chemical metasediments and minor units of clastic metasediments surrounding them. In thin section the chemical metasediments are seen to be layered, firstly on a very fine scale in which layers rich in magnetite, only one or two grains thick (0.1 to 0.3 mm), are traceable for several centimetres, and secondly on a much coarser scale, that can be seen on outcrop, in which layers 1 to 2 mm thick are defined by variation in magnetite, quartz, and iron silicate concentrations. Magnetite is the dominant iron-bearing mineral, but both grunerite and stilpnomelane are abundant in some laminae as is ankeritic dolomite.

White to rusty weathering, finely bedded to laminated chert which commonly displays weak magnetic attraction is intercalated with clastic metasediments and minor tuff units along the northern side of the largest island in Bamaji Lake. The chert is much finer grained than the surrounding clastic rocks (<0.2 mm), and in places exhibits intricate intraformational folding on a scale of only a few centimetres. Magnetite and pyrite are the only common iron-bearing phases present.

The other occurrence of chemical metasediment in this map area is located along the southern shore of a small lake south of Moosetegon Lake. A unit consisting of dark green actinolite, calcite, light brown ankeritic dolomite, phlogopite, chlorite, and pyrite with a maximum thickness of 2 m can be traced across a series of trenches for over 100 m. The rock termed a calc-silicate here, is highly inhomogeneous in terms of the distribution of its major components which occur in patchy masses and crude layers. The surrounding area is almost entirely underlain by pillowed and massive mafic flows intruded by numerous minor trondhjemitic sills. Adjacent to the chemical metasediments however there are several units of dacitic pyroclastic rock which both underlie and overlie the calc-silicate. Immediately overlying the unit is a sequence of clastic metasediments containing strongly banded pyritic layers. Overlying that is a thick (2 to 3 m) unit of lithic tuff which may actually consist of several separately deposited beds. Thin intercalations of actinolite-rich material only 1 to 2 cm thick occur at intervals within this pyroclastic unit. These are somewhat similar to the main calc-silicate unit and are undoubtedly of chemical origin.

The rather complex local stratigraphy is discussed in more detail in the Economic Geology Section of this report (*see* Urangesellschaft Canada Limited - Bamaji Lake Uranium Occurrences). The calc-silicate and the clastic metasedimentary rocks in the sequence described above are known to contain considerable gold and uranium. The stratigraphy can best be explained by the continuous deposition of a calcareous precipitate on a sea floor, while periodically, pyroclastic and clastic sedimentary material was introduced in relatively sudden short-lived events. The vague layering seen in the main calc-silicate unit

may be evidence of original bedding in this rock which could have been at one time a carbonate sequence. Metamorphism under low PCO_2 would favour the breakdown of the carbonates, and cause homogenization of the rock (Klein 1973).

A moderately strong aeromagnetic anomaly (ODM 1976b,c,e,f) can be traced along the regional strike very close to this unit, it is not however certain that the anomaly is caused by the sequence just described or whether an unexposed unit is responsible. The anomaly outlines part of the east-northeast-trending fold which passes through the northern part of Moosetegon Lake.

STRATIGRAPHY

The oldest rocks present are the metavolcanics which underlie most of the northwestern quadrant of the map area. Structural complications make it difficult to assess the total thickness of this pile accurately, but a minimum of 4000 m is estimable with some confidence between the axis of the Fry Lake Anticline (*see* Structural Geology) and the hydroelectric transmission line. These metavolcanics occur in two distinct sequences. The lower is a calc-alkaline sequence (*see* Petrochemistry of Metavolcanics) consisting of mafic flows and mafic, intermediate, and felsic pyroclastic rocks (Lower Metavolcanic Sequence of Figure 2) which occur in the Fry Lake and Kaginot Lake areas. All evidence, namely the presence of pillowed flows, extensive chemical metasedimentary units, and waterlain tuffs suggest that these rocks were predominantly if not entirely subaqueous. Stratigraphically overlying this mixed sequence, there is a thick succession of tholeiitic mafic pillowed flows (Upper Metavolcanic Sequence of Figure 2), which occurs across the southern part of Fry Lake and on the northern side of the Fry Lake Anticline near the northern boundary of the map area.

At a late stage in the accumulation of these metavolcanics, the pile was intruded by trondhjemite of the North Bamaji Lake Intrusion, a high level pluton, which gave rise to innumerable sill-like intrusions in the southern part of the area. It is also probable that this magmatic event produced some volcanic activity in this or closely adjacent areas. In any case, the intrusion probably caused a doming effect in the original relatively flat metavolcanic platform which eventually brought considerable areas above sea-level. Subsequently rapid erosion took place, wearing away the thin metavolcanic cap, and unroofing the trondhjemite. Hence, unconformably overlying the mafic metavolcanics and the North Bamaji Lake Intrusion is a sequence of conglomerates, now exposed along the north side of Bamaji Lake, consisting predominantly of trondhjemitic and mafic amphibolitic clasts.

The conglomeratic sequence on the northern side of Fry Lake was probably deposited at the same time as that just discussed, but the correlation is indeed tenuous. Because of deformation, the nature of these northern metasediments is difficult to establish, but their lens-like distribution and limited lateral extent tend to suggest a fluvial origin rather than a submarine fan environment (Walker 1976a,b,).

Overlying the conglomeratic rocks on the northern shores of both Fry and

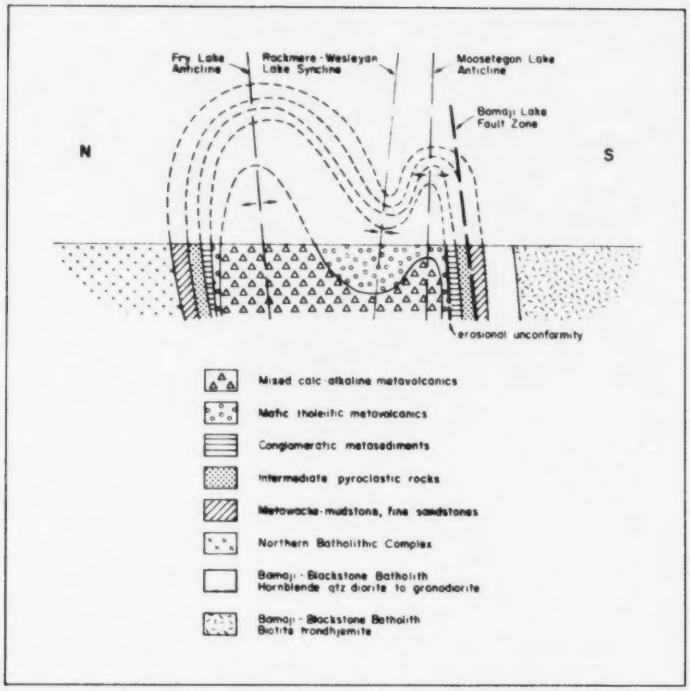


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Figure 4–Generalized north-northwest cross-section through the Fry-Bamaji Lake supracrustal belt showing inferred correlation of stratigraphy across the belt (reconstruction minus North Bamaji Lake Intrusion).

Bamaji Lakes there are sequences of younger metavolcanics (Bamaji Lake Pyroclastic Sequence of Figure 2). These are mostly intermediate pyroclastic rocks, but a few mafic flows occur in the lower part of the sequence along Bamaji Lake. The northern sequence probably forms a considerably thicker accumulation than that along Bamaji Lake, but abrasion along the Bamaji Lake Fault Zone may have reduced somewhat the apparent thickness of the southern sequence.

Along the northern side of Fry Lake the intermediate pyroclastic units are intercalated with metawacke-mudstone beds, and north of this mixed zone metasediments predominate. The rhythmically bedded, laterally continuous metawacke-mudstone units have the appearance of turbidites, but definitive evidence in terms of internal sedimentary structures (i.e. Bouma divisions) is lacking. Along the southern side of Bamaji Lake the metawacke sequence may be the equivalent of that north of Fry Lake, however, since the contact relationships between the pyroclastic rocks on the northern side of Bamaji Lake and these metasediments are unresolved due to the Bamaji Lake Fault Zone and

the lake itself, and since reliable facing criteria are lacking on both sides of the lake, this inferred correlation is far from unequivocal.

Near the top of the metawacke-mudstone sequence north of Fry Lake, there is another pyroclastic wedge, which may be related to the very minor tuff and chemical metasedimentary units in the Bamaji Lake metawacke sequence.

In summary the supracrustal belt which transects the map area is roughly symmetrical in terms of lithologic distribution about an east-west structural axis. There are three distinct metavolcanic cycles. The oldest is a mixed sequence of calc-alkaline mafic flows and mafic to intermediate pyroclastic units. The second, which consists almost exclusively of tholeiitic mafic flows, conformably overlies the first. The upper sequence predominantly consists of intermediate pyroclastic rocks and must be considerably younger than the first two since it is separated from them by an erosional unconformity.

The present configuration of the Bamaji-Fry Lake supracrustal rocks is shown schematically in Figure 4 as an idealized north-northwest-oriented cross-section through the local stratigraphy.

MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

A wide variety of minor intrusions ranging in composition from metamorphosed diorite and quartz diorite to peridotite occur within the map area. These rocks are certainly of several different ages, but cross-cutting relationships are few, and so far no absolute ages are available. Most of these rocks occur in sill-like bodies which intrude the supracrustal sequence, particularly the metavolcanics. Rare dikes of andesitic composition, possibly related to lamprophyre, clearly intrude trondhjemite and other granitoid phases in the northwestern part of the area. Where mafic or ultramafic rocks are found within granitoid terrain, they generally appear to be inclusions, commonly forming trains of subangular blocks or schlieren which can extend for hundreds of metres.

By far the most numerous and volumetrically significant mafic intrusive bodies are metagabbro sills in the Fry Lake-Kaginot Lake area. A few of these are notably porphyritic and are described separately below. The majority are aphyric medium- to coarse-grained amphibolites which vary considerably in texture and which can be impossible to distinguish from coarse flows. Metapyroxenitic phases occur in a few of the thicker sills in this area.

A series of sill-like metagabbro and diorite bodies occur along the length of Bamaji Lake on both sides of the Bamaji Lake Fault Zone (*see* Structural Geology) where they intrude both metasediments and pyroclastic rocks. Although these bodies vary quite markedly in composition and texture, they may be consanguinous.

The largest ultramafic intrusive body in the area is a highly dissected metapyroxenite sill traceable in outcrop and on aeromagnetic maps for at least 6.5 km along the southern side of Bamaji Lake. Smaller metapyroxenitic and metagabbroic lenses nearby, which follow the same general strike as the main sill, may be genetically related to it.

Relatively unaltered metaperidotite occurs in an intrusion of unknown shape and dimensions northeast of Kaginot Lake, where mafic intrusive rocks underlie a substantial portion of the area.

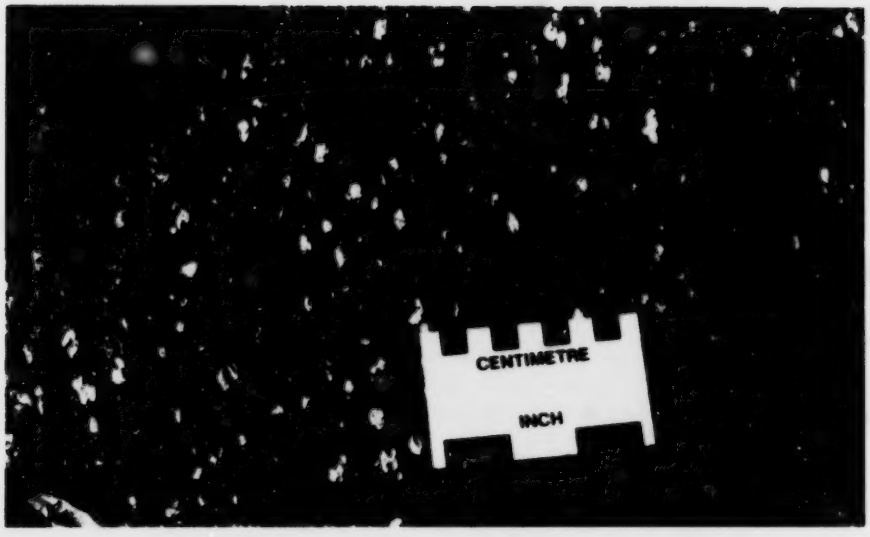

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Photo 6–Massive plagioclase-phyric metagabbro from the large metagabbro body north of central Fry Lake.

FRY LAKE PORPHYRITIC METAGABBRO INTRUSIONS

Metagabbro consisting of medium- to coarse-grained amphibolite with 5 to 75 percent white subhedral plagioclase phenocrysts forms three notable intrusions in the Fry Lake area. One is a sill about 200 m thick which can be traced from the extreme eastern edge of the map area across central Fry Lake and along the northern shore of the long western arm of the lake. Contacts are relatively sharp but in some places they are highly sheared. Flow layering parallel to these contacts is defined by concentration of plagioclase phenocrysts in concordant layers and lenses. Phenocrysts are on the order of 1 cm across in most layers. The crystals are equant to round and constitute from less than 2 to 70 percent of the rock in some layers.

In thin section the plagioclase crystals are almost completely saussuritized. The matrix appears to have had a subophitic texture now mimicked by actinolite and saussuritized feldspar laths. Pilotaxitic texture defined by fine plagioclase laths around the phenocrysts can be seen in some samples. Fine leucoxene and chlorite as well as secondary quartz and carbonate are minor constituents of most thin sections.

Porphyritic metagabbro very similar to that described above is one of the dominant phases in a large irregularly shaped subconcordant body which occurs north of the western bays of Fry Lake (Photo 6). Most of this intrusion con-

sists of schistose and gneissic metagabbro with few phenocrysts, but in many outcrops near its southern contact phenocryst concentrations of between 40 to 75 percent are found. The white equant subhedral plagioclase crystals are as large as 3 cm across but most are on the order of 1.5 cm. In some outcrops the porphyritic metagabbro can be seen cutting aphyric phases indicating a multiple stage intrusive process for this body. Petrographically these rocks closely resemble the metagabbro described above.

The small triangular mafic intrusion at the southeastern corner of Kaginot Lake consists predominantly of the same porphyritic metagabbro. Textures seen there are essentially the same as those found in the central Fry Lake sill. Indistinct layering in terms of phenocryst content does occur in places but through most of the body the plagioclase crystals are relatively evenly distributed at about 10 to 15 percent. Near the southeastern corner of this small intrusion the rocks have been sheared and the phenocrysts have become flattened and drawn out lenses in a vaguely gneissic matrix.

FRY LAKE APHYRIC METAGABBRO SILLS AND DIKES

Most of the mafic intrusions in the Fry Lake area are nonporphyritic. Sills are far more numerous and much larger than dikes which generally appear to be fine-grained offshoots of nearby sills. A few of the intrusions, such as the sill along the southern side of the T-shaped bay in western Fry Lake, appear to be layered with metapyroxenitic zones, but the vast majority are essentially homogeneous in term of both composition and texture. Textural variations between intrusions however are extensive, and appear to be due to the degree of shearing to which they have been subjected. Larger massive sills, on the order of 15 to 100 m thick, are generally coarse-grained with blastophitic or diabasic textures which can grade into gneissic and/or flaser gabbro lenses. In the smaller sills (<15 m thick), the central portion commonly consists of fine flaser or granoblastic metagabbro, and contact areas are schistose amphibolite. Porphyroblastic metagabbro with larger (1 to 2 cm) subhedral hornblende metacrysts in a blastophitic matrix is the least common of the textural variants found in the area.

Where not extensively sheared, contacts are sharp and regular and there is no evidence of contact metamorphism in the country rock.

Petrographic examination shows these rocks to consist of little other than plagioclase (and/or epidote after plagioclase), actinolite or hornblende, magnetite, and leucoxene. Secondary carbonate is an abundant constituent of sheared contact zones. Where actinolite is predominant, the amphibole forms patchy masses consisting of very fine felted crystals, but in hornblende-rich rocks the amphibole occurs as large subhedral single crystals.

Metapyroxenite, which is found in a few mafic intrusions in layers and lenses up to 10 m thick, consists mostly of actinolite, epidote, and talc with subordinant plagioclase (An_{35-45}) and chlorite.

BAMAJI LAKE METAGABBRO AND DIORITE SILLS

The mafic intrusions which occur along the length of Bamaji Lake differ from most of those around Fry Lake mainly in their textural inhomogeneity. Nearly all of these bodies consist of several texturally distinct layers. This appears to be due to pronounced differential shearing within the Bamaji Lake Fault Zone, and not to original compositional stratification.

In the southern part of Bamaji Lake almost all of the exposures are metagabbroic, and although the rocks differ considerably in texture and grain size from outcrop to outcrop, they appear to belong to a single sill about 300 m thick. Textural variations, particularly on the islands just off the north shore of the lake are quite striking. On any outcrop, subparallel zones from 10 cm to several metres wide can exhibit well-developed flaser texture, strongly schistose and gneissic textures, porphyroblastic or coarsely granoblastic textures, and blastophitic texture. Contacts between these textures are quite sharp (1 to 5 cm wide), planar, relatively fine grained, and high in ferromagnesian minerals. In a few outcrops, inclusions of the surrounding metasediments up to several tens of metres in length are enclosed within the metagabbro. These inclusions are granoblastic in texture, and are very coarse grained and biotite-rich in comparison with the country rocks.

Actinolite is the dominant amphibole in all thin sections of these metagabbros. It constitutes 55 to 95 percent of the rock depending upon the textural type, with highly sericitized, uralitized and/or saussuritized plagioclase, epidote, and Fe-Ti oxides making up most of the remainder. Biotite contents as high as 10 percent occur near metasedimentary inclusions and in the vicinity of the numerous pegmatite dikes which cut the mafic sills.

Several smaller sill-like bodies are exposed along the northern and southern shore and on small islands in the northeastern part of Bamaji Lake. Some of these may be correlated allowing for offsets due to NNE-trending faults. The two largest of these bodies outcrop on the north side of Bamaji Lake east of the Fry Lake falls and on the south side of the lake southwest of the falls. They consist essentially of metadiorite. On the northern side the intrusion is well within the Bamaji Lake Fault Zone. There, the metadiorite is fairly homogeneous in composition and texture. The rock is vaguely gneissic with segregations of quartzofeldspathic and amphibole-rich material. A pronounced lineation is also present, formed by the alignment of segmented quartz stringers and cigar shaped plagioclase-rich rods up to 8 mm long.

There is considerable variation in both texture and composition within the intrusion on the southern side of the lake. In some outcrops the rock grades from metadiorite to a much more melanocratic metagabbro, and near its southern contact with granodioritic and quartz dioritic phases of the Bamaji-Blackstone Pluton the sill appears granodioritic. Texturally there is a wide variation within single outcrops similar to the layering in the mafic intrusion in the southern part of the lake, but the layers are not as sharply bounded. Some outcrops are massive with relict igneous textures well-preserved but most exhibit a combination of schistose, porphyroblastic, gneissic, and flaser textures. In places, numerous metasedimentary inclusions occur within the intrusion.

The smaller mafic intrusions around the northeastern part of Bamaji Lake

are mostly gneissic to granoblastic metagabbro. A few resemble the layered metagabbroic bodies found to the southwest but most are quite uniform in texture.

The inclusion trains of granoblastic and gneissic metagabbro commonly found in the northern part of the Bamaji-Blackstone Pluton appear very similar to the above and are probably of the same age.

BAMAJI LAKE METAPYROXENITE

South of the central islands in Bamaji Lake, the remnants of a thick ultramafic body can be traced in scattered outcrop and also by a fairly strong aeromagnetic expression extending for at least 6 km. In places, the body is exposed over a width of 400 m but most of the remnant blocks are much smaller. The inferred contacts of the body closely follow trends in mineral foliation and gneissosity in the surrounding trondhjemite, and it appears likely that it was at one time a sill. There is little evidence as to the nature of the original country rock now totally assimilated and/or "granitized."

The green ultramafic material in many outcrops is criss-crossed by numerous, light pink pegmatite and aplite dikes (3 cm to 2 m thick) which weather high relative to the metapyroxenite and which make these exposures rather distinctive in appearance. Contacts with the surrounding trondhjemitic rocks were rarely observed, and where seen were obscured by pegmatite intrusions.

Overall, the metapyroxenite body is massive, nonfoliated, and relatively uniform in mineralogy and texture, but grain size commonly changes markedly over short distances. The rock is porphyroblastic with black poikiloblastic metacrysts of hornblende up to 2 cm across making up 10 to 20 percent of the volume. Large (1 to 2 cm) irregular patches of pink microcline and quartz are common, and are particularly abundant in outcrops strongly dissected by pegmatite injections. The matrix of the metapyroxenite is made up of light green granular augite, epidote, and plagioclase. It generally exhibits an even grained decussate texture. Augite, which is partially altered to hornblende in some thin sections, can make up over 80 percent of the rock. The hornblende poikiloblasts have inclusions of biotite, augite, epidote, sphene, and plagioclase of indeterminate composition.

KAGINOT LAKE METAPERIDOTITE

Northeast of Kaginot Lake several thick sills of metagabbro intrude the metavolcanic sequence. There is also at least one body of metaperidotite of poorly known shape and size, which, from its mineralogy and texture appears to be considerably younger than the sills. The metagabbro weathers dark green to grey and is generally gneissic. Outcrops of the metaperidotite are typically bold, massive, dome-shaped, and distinctly brown in colour. On fresh surface this rock is dark green and even-textured with a grain size of 1 to 2 mm. In thin section it exhibits the classic "net" texture common in peridotites. Completely serpentinized euhedral to ovoid olivine grains, mantled by very fine magnetite,

are enclosed in two types of pyroxene, essentially unaltered augite, and very highly altered pyroxene, now chlorite + talc + tremolite, but retaining subhedral to euhedral pyroxene form. Interstitial matrix consists of fine-grained felted talc, carbonate, magnetite, and minor secondary quartz.

Hand specimens of the rock are moderately magnetic and considerable compass deflection was encountered for several tens of metres around the metaperidotite exposures. Unfortunately, aeromagnetic maps are strongly influenced in this part of the area by magnetite and pyrrhotite-bearing chemical metasediments, and are of little use in tracing the extent of the ultramafic rocks which are exposed in only a few large outcrops.

LAMPROPHYRE AND RELATED ROCKS

Narrow vertical dikes of low weathering, black, biotite-rich lamprophyre were seen in only a few localities intruding metasediments in the extreme southwestern part of Bamaji Lake, and granitoid rocks in northeastern Kezik Lake. These intrusions are generally less than 20 cm wide with sharp planar contacts. Biotite and in some cases feldspar phenocrysts are present in these rocks and the matrix consists of biotite + chlorite with variable amounts of calcite. These are kersantites according to the classification of Moorhouse (1959).

Possibly related to these lamprophyre dikes are intrusions of similar size and limited distribution consisting of porphyritic andesite (map unit 5h). These rocks are low weathering, medium grey, and contain plagioclase and biotite or more commonly hornblende phenocrysts in a massive fine- to very fine-grained plagioclase + hornblende + chlorite matrix. Although not true lamprophyres, these dikes are included in this group on the basis of inferred genetic association.

A third type of minor, relatively uncommon intrusion may also be related to the above. In a few places around Fry Lake, notably on the southeastern shore and on the large northwestern bays, metavolcanics are intruded by very highly carbonatized mafic lenses or dikes. These intrusions are irregular in outline and the largest are on the order of 2 m wide. The rocks weather low with rugged surfaces. The carbonate (mostly calcite) weathers dull red and relatively resistant biotite-amphibole knots are light to medium green. Contacts with the country rock are sharp but quartz veinlets commonly obscure the margin of the intrusion. Samples of quartz and carbonate from these bodies were analyzed for gold with negligible results.

SOUTHERN BAMAJI LAKE META-QUARTZ DIORITE

In the south-central part of the area, a large island is underlain by coarse quartz diorite. For the most part these rocks have retained their hypidiomorphic-granular igneous texture made up of interlocking hornblende and plagioclase crystals. Most of the contacts with surrounding felsic to intermediate plutonic rocks are under water, therefore the dimensions of the intrusion are

problematical. Where contacts are exposed, inclusions of the quartz diorite occur within the trondhjemite and granodiorite. This plus the fact that in most outcrops the quartz diorite is intruded by wide pegmatite dikes definitely indicate that it is older than the surrounding rocks.

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

Rocks in this category underlie almost two-thirds of the map area. They form six major bodies, which are discussed below, and numerous smaller intrusions found in nearly all parts of the region. (1) The Bamaji-Blackstone Batholith which is relatively homogeneous within this area underlies most of the ground southeast of Bamaji Lake. (2) The North Bamaji Lake Intrusion is a hypabyssal trondhjemitic body which occupies most of the southwestern quadrant. (3) The Southern Pegmatite which intrudes both of the above appears to be post-tectonic. (4) The largest intrusion, the Northern Batholithic Complex, consists of a variety of lithologies and includes a large area north of Wesleyan and west of Kaginot Lakes. (5) The Obaskaka Lake Pluton is a subcircular body, only a small part of which occurs within the map area north of Fry Lake. (6) The Fry Lake Stock is a small feldspar porphyry mass of elliptical outline on the southeastern side of Fry Lake.

Figure 5 shows the rock classification scheme used in this report for felsic to intermediate plutonic rocks.

BAMAJI-BLACKSTONE BATHOLITH

Within the map area this pluton which was formerly termed the Bamaji-Blackstone Granite by Sage and Breaks (1976) occupies nearly all of the ground southeast of Bamaji Lake and extends for many kilometres to the south (Sage and Breaks 1976). Locally there are two distinct phases. The bulk of the intrusion is formed by a weakly foliated to weakly gneissic leucocratic biotite trondhjemite, and along the northern contact of the batholith there is a zone of quartz diorite to hornblende granodiorite forming a rim from 500 m to over 1100 m in width.

The contact phase, which occurs along the northern side of the large islands in Bamaji Lake, is hornblende-rich, and varies from massive in the centre of the zone, to strongly foliated near both its northern and southern margins. Near its northern contact with supracrustal rocks the quartz diorite is inclusion-rich. Broad trains of massive amphibolite xenoliths up to 30 cm long occur up to 200 m from the metasediments found to the north. Within 50 m of that contact there are many unusual and highly variable hybrid phases, generally rich in biotite. Indeed, in some outcrops it is very difficult to distinguish between hybridized granitoid material and coarsely recrystallized quartz-feldspar-biotite schists.

Approaching the southern contact of this quartz-diorite zone with the biotite trondhjemite in the core of the batholith, the rock becomes markedly more

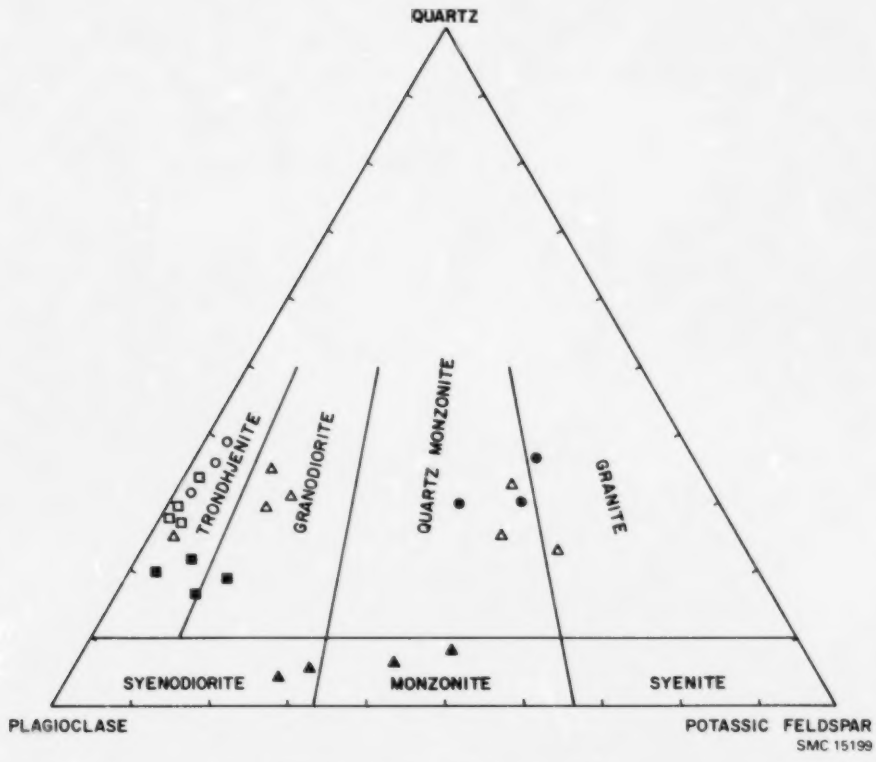

Figure 5–Quartz-potassic feldspar-plagioclase diagram showing the classification scheme for felsic to intermediate plutonic rocks used in this report and examples of modal analyses from the Slate Falls area (plot after Ayres 1972).

ferromagnesian-rich and develops a strong mineral foliation. Hornblende tends to form clotty masses up to 3 cm long within a few tens of metres of the contact. Although never actually observed, the contact between quartz diorite and trondhjemite must be quite sharp and remarkably regular in outline since its location can be readily interpolated. There are rarely indications of the relative ages of these two phases. Intrusion breccias are exposed on a few small islands near their contact, and further south within the homogeneous tron-

dhjemitic mass of the pluton, inclusions of hornblende-rich granodiorite, very similar to that in the contact zone occur in several places. This evidence suggests that the marginal quartz diorite is the older phase.

Petrography of the quartz diorite to granodioritic rocks shows allotriomorphic-granular and commonly slightly porphyritic features with zoned phenocrysts of plagioclase (>5 mm across) forming up to 10 percent of the rock. Typically these rocks consist of 10 to 30 percent hornblende, 40 to 55 percent sericitized or uralitized plagioclase, 5 to 10 percent biotite, and 10 to 25 percent quartz. Microcline and microcline perthite constitute up to 8 percent in some sections but 1 to 3 percent is more common. Sphene, epidote, apatite, and allanite are the common accessory minerals.

The leucocratic trondhjemite which forms the core of the pluton is remarkable for its uniformity. Biotite + hornblende form between 5 to 12 percent of the rock with biotite predominating commonly to the exclusion of the amphibole. The mineral foliation is quite weak in most parts of the intrusion. A rather nebulous layering parallel to the mineral foliation is due to very slight differences in colour and grain size between adjacent layers which are on the order of 2 to 30 cm wide. The faint colour differences do not appear to be due to any variation in the content of any specific mineral. Whether this phenomenon is the result of metamorphic differentiation, remnant bedding in "granitized" supracrustal rocks, differential shearing, or repeated magmatic injections is still not clear; but the layering is a regular structural feature which provides consistent planar orientations both locally and throughout the pluton. Trains of amphibolite schleiren, which probably represent dissected mafic intrusions, are common in the northern part of the batholith. These also tend to parallel the layering and mineral foliation of the trondhjemite.

These rocks have a seriate allotriomorphic-granular texture with weak to fairly strong biotite foliations. They consist of 5 to 12 percent biotite, 0 to 5 percent hornblende, 40 to 66 percent plagioclase (An_{35-40}), 25 to 40 percent quartz, and 1 to 3 percent microcline. Apatite, sphene, and zircon are ubiquitous accessories and the percentage of granular epidote ranges from 1 to 3 percent.

NORTH BAMAJI LAKE INTRUSION

The body, formerly called the Bamaji Lake Complex by Sage and Breaks (1976) is centred around North Bamaji Lake. It is bounded to the south by an erosional unconformity and overlying metasediments, and to the east by mafic metavolcanics which it intrudes; but its northern and western contacts are only vaguely known (Sage and Breaks 1976) (Photo 7). The intrusion consists almost entirely of leucocratic trondhjemite which forms two main phases: a medium-grained foliated biotite trondhjemite with cataclastically induced porphyroidal features, and the other, which is less abundant, a finer grained leucocratic biotite trondhjemite which appears to intrude the first. In a few localities, medium-grained quartz dioritic to granodioritic phases also intrude the first phase but these appear to be quite uncommon.

Rocks having primary igneous textures are rarely found in the southern and central parts of this intrusion. It is crossed by several major east-west

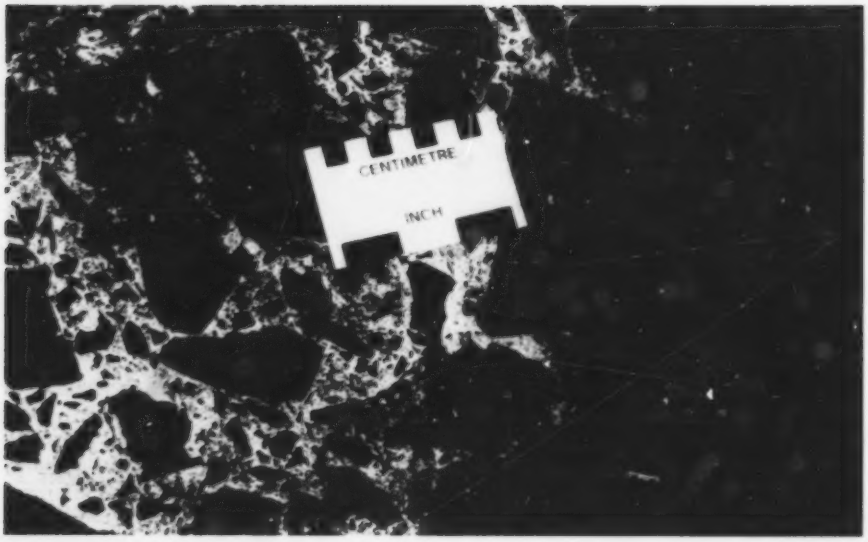

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Photo 7–Intrusion breccia of medium-grained mafic amphibolite, probably metavolcanic, injected with fine trondhjemite found in southern Wesleyan Lake near the metavolcanic contact.

trending fault and shear zones (shown as lineaments on the accompanying maps, back pocket) which have cataclastically deformed all lithologies to varying degrees. Many more minor shear zones exist but they are not shown individually to avoid confusion. The original textures of these rocks were almost certainly hypidiomorphic-granular. In the first stage of cataclasis only the quartz is affected as single quartz crystals are strained and finally break up forming a "mortar" between relatively euhedral plagioclase grains. Thus the plagioclase crystals take on the appearance of phenocrysts in the quartzose mortar. With more intense deformation the quartz forms lenses and veinlets producing an anastimosing network between the plagioclase grains which become more lensoidal (augen-like) with attendant quartz-filled pressure shadows. Muscovite with a well-developed preferred orientation defines foliation which parallels the augen and sweeps around the better preserved plagioclase phenocrysts. In the next stage of cataclastic degradation the quartz lenses break up into distinct ovoid to subcircular "eyes". Original plagioclase crystals are completely obliterated, becoming polycrystalline augen surrounded by muscovite. Eventually, in the extreme case, the rock takes on an equigranular texture in which vague augen of quartz and feldspar can be seen with difficulty. Where recrystallization has occurred, such as in the extreme southern part of the intrusion where younger rocks of the Southern Pegmatite have provided a heat source, a granoblastic texture has developed in these rocks, without foliation.

Of the cataclastic variants described here the most common rock type is a medium-grained porphyroidal trondhjemite with quartz "eyes" and feldspar "phenocrysts". Contacts between sheared equivalents can be sharp or gradational. Indeed many contacts are so sharp that they appear to be intrusive unless closely examined. Like some of the mafic intrusions found along the length of Bamaji Lake, many of the outcrops of the trondhjemite display layers from 1 cm to several metres thick representing textural variations of the same rock type produced by differential cataclasis and shearing.

North of North Bamaji Lake the effects of shearing on the trondhjemite rocks diminish gradually. The main phase south of Wesleyan Lake is a weakly foliated, leucocratic, equigranular trondhjemite with hypidiomorphic-granular texture. The contact of rocks belonging to this intrusion with the complex of generally more potassic phases found to the north appears to be very irregular, and is difficult to delineate with certainty given the slight differences between some phases on opposite sides of that contact.

In the area around the northeastern corner of North Bamaji Lake the trondhjemitic rocks interfinger with mafic metavolcanics which they intrude. The lithologies are intimately intermixed, in many places forming *lit-par-lit* sequences with mafic lenses and trondhjemitic sills only 1 to 5 m thick. Contacts between the sills and mafic metavolcanics are very sharp and the metavolcanics show no metamorphic or metasomatic effects due to the minor intrusions. The smaller trondhjemitic bodies are generally porphyritic but vary widely in texture, grain size, and proportions of phenocrysts. Massive feldspar porphyry sills, with few quartz phenocrysts and with euhedral plagioclase crystals from 2 to 4 mm across forming up to 30 percent of the rock in a grey aphanitic matrix, are the most common type of minor intrusions. Feldspar quartz porphyry bodies with small white euhedral plagioclase and large round grey quartz phenocrysts in roughly equal proportions are also common. White nonporphyritic felsite and very fine grained to aphanitic trondhjemite dikes and sills are abundant, but are generally too small to be coded individually on the accompanying maps.

The mineralogy of the trondhjemitic rocks in the North Bamaji Lake Intrusion shows remarkably little variation despite the radical textural differences evident across the main intrusion and the minor sills to the east. The rocks consist of quartz (25 to 35 percent), oligoclase (45 to 60 percent),biotite (3 to 8 percent), muscovite (2 to 10 percent), microcline (up to 3 percent), and epidote (up to 3 percent). Chlorite and carbonate occur in highly variable amounts, and sphene, magnetite, apatite, allanite, and tourmaline are common accessories. Sulphide minerals, mostly pyrite, pyrrhotite, chalcopyrite and molybdenite, occur sparsely disseminated in the southern part of the intrusion, particularly along the southern side of North Bamaji Lake. Total sulphide content can be as high as 5 percent in some outcrops. The sulphide mineralogy of this intrusion is further discussed in the Economic Geology section of this report.

SOUTHERN PEGMATITE

In the extreme southern part of the western half of the area, pink leucocratic granitoid to coarsely pegmatoid quartz monzonite and granite (*sensu*

stricto) intrude supracrustal rocks as well as trondhjemite phases of both the Bamaji-Blackstone Batholith and the North Bamaji Lake Intrusion. Intruding the metasediments along the northern side of Bamaji Lake, the pegmatite forms numerous sills from 1 to 20 m thick. Crosscutting dikes of the same material are less common and on average, are much smaller. Contacts are sharp and large biotite schist inclusions are commonly found in these intrusions.

The contact between the quartz monzonitic rocks and rocks of the North Bamaji Lake Intrusion is similar to the above in that across a gradational zone at least 1 km wide between the two bodies numerous sills of the pegmatite intrude the trondhjemite and inclusions of trondhjemite from a few centimetres to hundreds of metres in size occur in the coarser more potassic rock.

The Southern Pegmatite varies greatly in grain size over short distances but sharp intrusive contacts within this phase are rarely seen. Unlike all the other rock types in this part of the area, the quartz monzonite appears unaffected by shearing and cataclasis. Outcrops are invariably massive, without layering, and lacking in foliation, all of which suggests a post-tectonic age for these rocks. The contacts between the main mass of the Southern Pegmatite and phases of the Bamaji-Blackstone Batholith are not exposed because they occur below Bamaji Lake, but the myriad pegmatite dikes which intrude the latter pluton appear to be related to the former at least in the south-central part of the area.

The quartz monzonite and granite consists essentially of quartz (25 to 35 percent), microcline (30 to 45 percent), microcline perthite (0 to 20 percent), oligoclase (15 to 35 percent), muscovite (5 to 10 percent), and biotite (2 to 5 percent). Tourmaline is abundant in some localities where it may constitute 10 to 15 percent of the rock. Zircon, sphene, apatite, and allanite are common accessories. Textures are hypidiomorphic-granular, but in some of the finer grained rocks microcline perthite forms phenocrysts markedly larger (> 1 cm) than the matrix crystals.

Tourmaline-bearing quartz veins were found in several places cutting trondhjemitic rocks in the southern part of North Bamaji Lake. These veins commonly contain several percent pink microcline and appear to be transitional between simple quartz veins and pegmatite dikes associated with the Southern Pegmatite.

NORTHERN BATHOLITHIC COMPLEX

The northwestern portion of the area is underlain by part of a batholith which extends for many kilometres to the north and west (Sage and Breaks 1976). Within the map area, the batholith appears to be crudely zoned in terms of the average composition of the lithologies present. Immediately north of the trondhjemitic rocks belonging to the North Bamaji Lake Intrusion, there is a broad zone of predominantly granodioritic rocks varying in width from 2 to 5 km. North of this relatively simple zone, the batholith becomes far more complex in terms of the number of rock types present and their distribution. From crosscutting relationships and the abundance of potassic phases in the northern zone, it is inferred to be a younger part of the batholith. Within the north-

ern zone itself it is evident that the potassium content of the rocks increases with decreasing relative age.

In the southern zone of the complex the predominant phase is massive to weakly foliated equigranular biotite granodiorite grading locally to biotite trondhjemite. The only other common rock types are massive, pink pegmatite and massive, relatively fine grained, equigranular biotite quartz monzonite, both of which intrude the granodiorite. In most of the southern zone these younger rocks are subordinate to the granodiorite, but locally, such as in the area north and west of Upper Kaginot Lake, they make up a significant proportion of the batholith. Contacts between the granodiorite and the younger phases are generally sharp and commonly cut across weak mineral foliation in the granodiorite.

The biotite granodiorite itself appears to consist of a number of different phases having distinct textural aspects but very similar mineralogies. Most common is a massive hypidiomorphic granular rock containing about 5 percent biotite. In the area east of Wesleyan Lake the plagioclase in this phase is coated with fine hematite giving it a pink or red cast. Another common rock type exhibits a seriate texture in terms of equant plagioclase euhedra. This grades into a distinctly porphyritic variant with anhedral plagioclase (An_{30}) phenocrysts up to 1.5 cm across. A third rock type is porphyritic in terms of both plagioclase and microcline, and yet another is both quartz and microcline phyric. An unusual phase which occurs in several places in the area, notably along the Cat River south of Kezik Lake, is characterized by clotty distribution of ferromagnesian minerals. In this granodiorite most of the biotite and much of the epidote present occur in ovoidal knots up to 2 cm across in a hypidiomorphic-granular matrix.

Average composition of these granodioritic phases is approximately quartz (30 to 40 percent), oligoclase (45 to 60 percent), microcline (6 to 15 percent), biotite (3 to 10 percent), muscovite (2 to 5 percent), and epidote (1 to 3 percent).

The quartz monzonite which intrudes the granodiorite phases generally has a nonfoliated allotriomorphic-granular texture and a very low colour index. The average composition is quartz (25 to 30 percent), oligoclase (20 to 40 percent), microcline + microcline perthite + antiperthite (30 to 50 percent), biotite (1 to 3 percent), and muscovite (0 to 4 percent).

Within the complex northern zone, in the northwestern corner of the area in particular, it is not unusual to find up to twelve texturally and compositionally distinct phases in a single outcrop. Exposures in which at least five phases occur are very common. For obvious reasons it is impossible to depict this lithologic complexity on the accompanying maps which are generalized and simplified for this part of the map area.

On many of the lithologically complex outcrops it is possible to determine the relative ages of the rock types present. In general the oldest rock types are inclusions of foliated biotite trondhjemite, cut and included within fine-grained massive leucocratic trondhjemite. These phases are similar to the two dominant trondhjemitic rock types in the North Bamaji Lake Intrusions. They are further intruded by massive coarse-grained biotite trondhjemite which is a very common phase in this part of the area. The next intrusive phases are two types of granodiorite, one equigranular, and the younger porphyritic with plagioclase and quartz phenocrysts. All of the above are intruded and included by

a dark pink weathering, coarse grained, porphyritic quartz monzonite with large (up to 2 cm) equant microcline phenocrysts, and then by a younger leucocratic quartz monzonite to granitic (*sensu stricto*) phase which is equigranular and relatively fine grained. The youngest intrusive rocks present in most cases (*see* Lamprophyre and Related Rocks, Mafic and Ultramafic Rocks) are a variety of pegmatitic and aplitic dikes, some of which themselves are multiphase and/or highly zoned. Contacts between the granitoid and pegmatoid phases are almost invariably sharp. Some chilling and hematitic staining along the contacts are quite common.

Correlation of the many phases present is difficult between widely scattered outcrops but some generalizations can be made regarding the intrusive history of this zone. Although the intrusive sequence outlined above is only one example of those found in mapping, the progression from trondhjemitic (potassium-poor) to quartz monzonitic (potassium-rich) rocks with time appears to be the rule. Locally, granodioritic phases are found intruding porphyritic quartz monzonite, but in general the sequence of intrusion in terms of relative composition is quite regular. In terms of abundance, quartz monzonitic and granodioritic rocks are predominant in this zone as a whole, but locally, the older trondhjemitic rocks are of major importance.

OBASKAKA LAKE PLUTON

This intrusion named by Sage and Breaks (1976) is a subcircular body about 15 km in diameter, located north of the eastern part of Fry Lake. Only a small part of the pluton occurs within the map area and is considered in this report, but the rest has been described by Sage and Breaks (1976). In that account this intrusion was interpreted, from contact relationships around the body, to be a "*syntectonic to late-tectonic mesozonal diapiric pluton which has imposed a warp upon the metavolcanic structural trends.*" The limited data on the pluton available from this study support this interpretation.

Within the map area, the contact with the surrounding metasediments is fairly sharp. On the metasediment side several thin quartz monzonitic sills (<2 m thick) intrude the country rocks for roughly 200 m south of the pluton. Within the pluton, as the contact is approached the rocks become more strongly foliated and amphibolitic inclusions become more numerous. In many places the contact phases contain hornblende clots up to 3 cm across.

According to Sage and Breaks (1976) the dominant phases in the pluton are massive porphyritic to equigranular leucocratic to melanocratic biotite and hornblende biotite quartz monzonite, but they indicated that the quartz content decreases markedly toward the margins. Two main phases are found within the map area. The older, and dominant rock type is a moderately foliated, equigranular, biotite-hornblende monzonite. This is intruded in some places by a porphyritic biotite-hornblende to hornblende-biotite monzonite to syenodiorite containing euhedral microcline and microcline perthite phenocrysts up to 1.5 cm across. This phase typically cuts across the foliation in the older monzonite.

In thin section the older rock has an allotriomorphic-granular texture and

consists of quartz (5 to 8 percent), microcline (40 to 55 percent), oligoclase (20 to 30 percent), hornblende (8 to 15 percent), and biotite (3 to 5 percent). Large (1 to 4 mm) sphene crystals as well as zircon and apatites are common accessories. Myrmekitic intergrowths were found in some thin sections. Hornblende occurs as both single euhedral crystals and as anhedral grains in clots with biotite.

Petrographic examination of the younger monzonitic to syenodioritic phase shows that it consists of quartz (3 to 6 percent), microcline and microcline perthite (25 to 35 percent), oligoclase-andesine (40 to 55 percent), hornblende (10 to 15 percent), and biotite (5 to 10 percent).

FRY LAKE STOCK

South of the eastern end of Fry Lake is a small (2.6 km by 1.0 km), roughly elliptical stock of intermediate plagioclase porphyry. Typically this rock consists of 5 to 20 percent pink to white weathering euhedral oligoclase phenocrysts 2 to 5 mm in length in a grey-green weathering massive aphanitic matrix. This matrix is made up mostly of quartz plagioclase and sericite in roughly equal proportions with minor biotite and variable amounts of pyrite and magnetite euhedra. Secondary carbonate, mostly calcite, constitutes a high proportion of the rock in some samples.

Overall the intrusion is quite homogeneous in mineralogy and texture, but some differences are notable near contacts with the surrounding mafic metavolcanics. The volume percent of plagioclase phenocrysts decreases toward the margins of the intrusion, and the remaining phenocrysts tend to be strongly aligned. This alignment appears to be due to shearing rather than magmatic flow. Adjacent to the contact the rock is sheared to such an extent that it is quite fissile, and the phenocrysts lose their shape, becoming thin lenses up to 2 cm long. The actual contacts of this porphyry body were not seen while mapping, but Sage and Breaks (1976) report that in drill core a 1 cm wide chill zone appears conformable with the country rock schistosity. The intensity of shearing close to the contact was also obvious in the core.

MINOR INTRUSIONS

Felsic to intermediate sills and dikes from a few centimetres to tens of metres in width are very common in this area. These fall into two broad categories: pegmatites, which are more common in the plutonic terrains, and porphyry types found almost exclusively intruding supracrustal rocks.

Pegmatitic to aplitic rocks of quartz monzonitic to granitic (*sensu stricto*) composition form minor intrusions found throughout the Bamaji-Blackstone Batholith, in many places along the southern part of the North Bamaji Lake Intrusion, and throughout most of the Northern Batholithic Complex. Such rocks rarely extend far into the supracrustal sequences but are known to cut all supracrustal lithologies and nearly all intrusive rock types. The pegmatites occurring in the northern and southern parts of the area probably differ in their

magmatic affinity since they are separated by several kilometres of terrain essentially devoid of pegmatites, but there are no gross mineralogical or textural differences obvious between them. As mentioned in a previous section, the complex outcrops in the extreme northwestern corner of the map area commonly include at least three pegmatite types of different ages. These differ in grain size, quartz/microline ratio, and colour, but this is readily apparent only where they occur together and intrude one another.

Mineralogically these rocks are very simple, consisting of microcline (40 to 55 percent), albite (20 to 30 percent), quartz (25 to 35 percent), muscovite (0 to 15 percent), and biotite (2 to 5 percent). Tourmaline and actinolite are fairly common accessory minerals in the southern part of the area but were not found in the pegmatites from the north. In a few cases microcline forms phenocrysts 2 to 3 times larger than the surrounding quartz and feldspar but generally the three main minerals form grains roughly equal in size. Internal zonation was rarely observed, but a few examples were seen in the northern and southern plutonic areas. The zonation involves sharp changes in grain size and texture with relatively slight variations in mineralogy.

In several places pegmatite dikes with very high quartz content were seen to grade into quartz veins containing a few percent (2 to 10 percent) microcline. Such veins appear to be related to molybdenite mineralization in the southern part of the North Bamaji Lake Intrusion.

Porphyritic intrusions, mostly sills with aphanitic to fine-grained matrices ranging in composition from trondhjemitic to quartz monzonitic, occur in all parts of the supracrustal belt. Those in the immediate vicinity of the larger intrusions, the Bamaji-Blackstone Batholith (granodiorite sills), the North Bamaji Lake Intrusions (trondhjemitic sills and dikes), and the Obaskaka Lake Pluton (quartz monzonitic sills) have already briefly been discussed, but there are a great many more in the Fry-Rochmere-Moosetegon Lakes area bearing no obvious relation to any of these major bodies.

The variety of textures and compositions among these minor intrusions is considerable. Plagioclase and antiperthite are the most abundant, and commonly the only minerals occurring as phenocrysts, but quartz "eyes" do occur in many intrusions and predominate in a few. Phenocryst point density ranges widely from 5 to 50 percent but 15 to 25 percent is most common. Biotite is generally the only ferromagnesian mineral present in essential quantities, but chlorite and epidote occur in minor amounts in most examples. Muscovite can form a high proportion of the rocks (up to 20 percent).

In the central Fry Lake area in particular, these intrusions appear to have taken up much of the shearing stress in the predominantly mafic metavolcanic sequence. Hence the porphyries are commonly highly fissile, with strong muscovite-dominated schistosities. Quartz phenocrysts tend to form polycrystalline lenses smeared out parallel to this schistosity, but plagioclase phenocrysts suffer only crushing around their edges. Carbonate alteration can be intense in such rocks. The final result is to give the rocks a layered and/or pseudo-fragmental appearance. Where recrystallization has occurred, the plagioclase phenocrysts form large (1.0 to 1.5 cm) subhedral to anhedral poikiloblastic grains usually in a granoblastic matrix of quartz, feldspar and muscovite.

REGIONAL METAMORPHISM

As in many Archean greenstone belts the supracrustal rocks in this area exhibit a crude zonation of metamorphic grade. The core of the Fry-Bamaji Lake belt is made up of rocks which have attained (almandine) low grade conditions (Winkler 1976). At the margins of the belt, where the supracrustal rocks are in contact with plutonic masses, medium grade (cordierite-almandine) conditions have prevailed.

In the medium grade areas, hornblende with oligoclase-andesine form the mafic metavolcanics, while in the interior of the belt actinolite and/or hornblende plus albite are the essential constituents of these rocks. The clastic metasediments occur almost exclusively in the margins of the belt. In some places biotite schists contain cordierite or andalusite, but generally the occurrence of index minerals is rare. Sage and Breaks (1976) report finding sillimanite in the absence of muscovite and epidote in metawackes from the northern part of the belt, but no sillimanite has been identified in the map area.

AEROMAGNETIC DATA AND GEOLOGY

Two sets of aeromagnetic maps are available on this area. The ODM-GSC total field maps compiled from a survey done in 1959 and published at a scale of 1:63 360 show very little detail over the present area (ODM-GSC 1960a,b). The only feature clearly discernible on these maps is the Fry Lake anticline (*see* Structural Geology) which is outlined by positive anomalies over magnetite-bearing chemical metasedimentary units.

In 1975 a high resolution aeromagnetic survey was flown over an area roughly coincident with the present geological map. From this survey residual total intensity magnetic maps were derived and published at a scale of 1:15 840 (ODM 1976a,b,c,d,e,f). Although far more detail was apparent in this series of maps, the narrowest linear anomalies were still relatively broad, suitable for outlining major structural and lithologic features (folds, faults, intrusive contacts, etc.), but they were of limited usefulness in tracing individual supracrustal units (e.g. flows with slightly different magnetic susceptibilities).

In 1977 V.K. Gupta, geophysicist, Ontario Geological Survey, rendered the high resolution aeromagnetic maps more useful for field correlation purposes by performing several types of computerized data manipulation. To enhance near surface (supracrustal) magnetic effects over those due to lower crustal features, downward continuation maps (Gupta and Wadge 1980) were prepared from the total field maps. Second derivative maps (Gupta and Wadge 1980) which substantially reduce the width of anomalies, and magnetic susceptibility maps (Ervin 1972) which enhance the relatively small susceptibility differences between supracrustal units were also produced. In most parts of the supracrustal belt these maps were effective in allowing precise correlation. For example, in the area between western Fry and Bamaji Lakes which is underlain by a sequence of rather monotonous mafic metavolcanics, pillowed flows of higher susceptibility outline several major folds the axial traces of which are shown on the accompanying geological maps.

Unfortunately these manipulative techniques were not as successfully employed in the northeastern part of the area where details of structure and stratigraphy are still obscured by the overriding effects of the anomalies associated with magnetic chemical metasediments.

Cenozoic

QUATERNARY

Pleistocene

The region has few prominent Pleistocene features. The pervasive ground moraine consisting of gravelly sand and silt is generally thin (1 to 10 m) probably averaging less than 5 m, and shows very little relief. Glacial fluting of this overburden is apparent in most parts of the region, but in the immediate map area it is not well-developed because of the thin discontinuous nature of the ground moraine. Ice flow directions were also indicated by glacial striae which are common on mafic metavolcanic and granitoid outcrops. The average direction of movement was found to be between 238° and 242°.

The only topographically significant glacial feature in the area is a southwest-trending esker system extending between Kaginot and Wesleyan Lakes. Only the northern part has the high (up to 20 m), narrow, steep-sided, and sinuous form characteristic of classic eskers. The western portion is a broad (100 to 600 m), relatively flat, gradually rising sub-sinuous ribbon of bouldery sand, which is pitted in a few places and which is flanked by several sizeable kettle-like depressions.

The only existing surficial geological map which includes the area (Prest 1963) shows very little detail in this region.

STRUCTURAL GEOLOGY

Regional Setting

The Early Precambrian (Archean) supracrustal and intrusive rocks in this region fall within the major tectono-stratigraphic subdivision of the Superior Province known as the Uchi Subprovince (Ayres *et al.* 1971). The contact with the English River Subprovince is some 20 km to the south of the area, and the Berens River Block (Ayres *et al.* 1971) is an average of 35 to 40 km to the north.

The supracrustal sequences in this section of the Uchi Subprovince have been isoclinally folded along roughly east-west-trending axes, and have been severely dissected by the surrounding plutonic masses. The Fry-Bamaji Lake supracrustal belt which exhibits mostly east to east-northeast-trending struc-

tural features appears to form the southern limb of a major synclinal structure, the axis of which extends from south of Dorothy Lake to Teevin Lake (Sage *et al.* 1972). The northern arm of this fold, known as the Meen-Dempster Lake belt (Sage and Breaks 1976) has structural features which trend east-southeast. The Obaskaka Lake Pluton appears to have pierced the supracrustal rocks near the axis of the major syncline, shouldering aside and warping the younger rocks.

In the western part of the map area plutonic masses completely sever the Fry-Bamaji Lake belt from the Ferdinand Lake belt (Wallace 1979c) with which it is clearly correlative. A very large area south of Bamaji Lake is underlain almost entirely by plutonic rocks leaving only small metavolcanic vestiges sandwiched between individual intrusions.

Major Structural Features

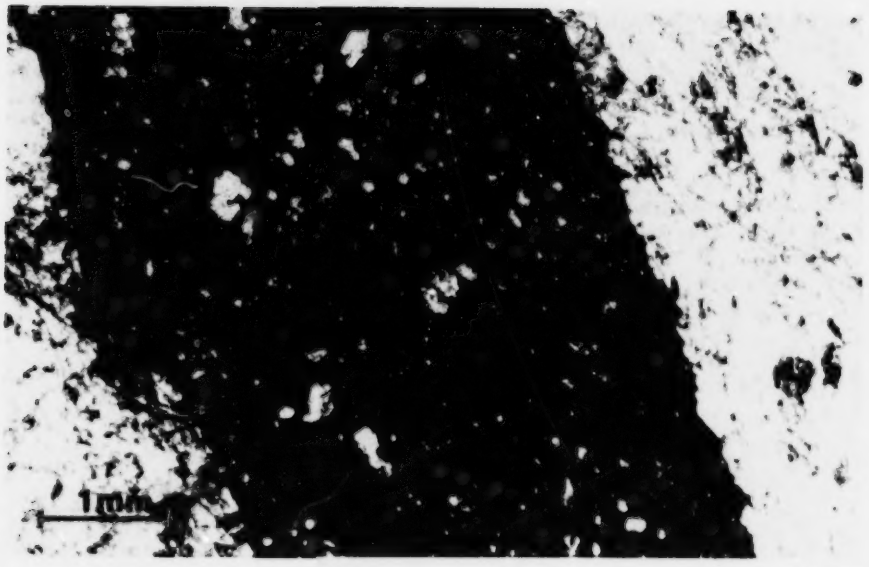
MAJOR FOLDS

Three major folds appear to control the structure in the local supracrustal sequence. The Fry Lake Anticline is the largest, most complex and best defined of these structures. Part of the fold has an east-plunging axis and an east-trending axial trace passing through the northern part of Fry Lake. This part is well documented in terms of both facing criteria and lithologic and aeromagnetic distribution patterns. Just east of Kaginot Lake the fold forms a domal structure with divergent axial traces which extend northward out of the map area between Burley and Scanes Lake, and southwestward subparallel to the arms of Kaginot Lake. Stratigraphic top determinations are rather scarce in these areas, but the structures can be interpreted from aeromagnetic data and outcrop distribution patterns visible on air photos.

The Rockmere-Wesleyan Lakes Syncline is another major east-trending relatively shallowly east-plunging fold which transects most of the area. Its axial trace extends from the south-central portion of Fry Lake, passing north of North Bamaji Lake to southern Wesleyan Lake. Closure north of Konegon Lake is obvious from outcrop patterns. Foliation dips in the metavolcanics are shallow ($<70°$) in comparison with the rest of the area. They face inward symmetrically about the axial trace of the fold nicely reinforcing the pattern obtained from airphoto interpretation.

At the extreme southwestern end of Senior Lake a sequence of mafic metavolcanics forms a west plunging syncline similar in all respects to that north of Konegon Lake (Wallace 1979c). These formed at one time a continuous structure and, as Sage and Breaks (1976) suggested, what we see there now is the "thin keel zone" of the fold which has been warped upward by intrusion of trondhjemitic rocks south of Senior Lake, creating the two separate, oppositely-plunging segments found at the present level of erosion. Elsewhere in the map area along the length of this fold its axial trace is defined by aeromagnetic and foliation distribution patterns.

The third fold which is somewhat less well-defined has an axial trace which



OGS 10 651

Photo 8–Photomicrograph (plane polarized light) of a dikelet of very dark pseudotachylite with numerous inclusions of country rock cutting metawacke. Thin section from sample taken just east of Fry-Bamaji Lake Falls.

extends subparallel to the power transmission line south of Moosetegon Lake. Interpretation of this fold is based on strong aeromagnetic evidence indicating closure to the northeast, and on foliation patterns indicative of an antiformal structure. Facing criteria are lacking in this area which is underlain by a monotonous sequence of mafic flows, but some stratigraphic evidence suggests that the fold is an anticline. This agrees with observations from minor folds which are northeast-plunging in that part of the supracrustal sequence.

MAJOR FAULTS AND LINEAMENTS

As is evident from the accompanying maps, major faults and topographic lineaments believed to be related to faults are numerous in this region. In general these features have been indicated simply as lineaments on the map unless stratigraphic offsets across them were positively identified.

The most prominent fault runs down the length of Bamaji Lake parallel or subparallel to the strike of the supracrustal rocks on either side. Rocks on the north shore are intensely sheared, and spectacular veinlets of pseudotachylite (Spry 1969) are quite common over a width of at least 200 m across the fault zone (Photo 8). The abundance of perfectly preserved pseudotachylite suggests

that shearing along this zone was late in the deformational and metamorphic history of the area. The progressively less intense cataclastic deformation can be traced for at least 300 m away from the main fault which, as is suggested by the presence of weak electromagnetic conductors (Palonen and Speed 1977), extends directly along the axis of Bamaji Lake.

Relative movement across this Bamaji Fault Zone is not known since no units have been correlated on both sides. Major lineaments in the Bamaji-Blackstone Batholith may be the slightly offset equivalents of northeast-trending faults on the southern side of Fry Lake, but this cannot be demonstrated conclusively.

East of the map area the Bamaji Lake Fault is lost under Pleistocene cover and appears to die out. South of the area however, it continues for many kilometres down the long southwestern arm of Bamaji Lake.

The sharp contact between the two major phases of the Bamaji-Blackstone Batholith runs parallel to the Bamaji Lake Fault Zone for most of its length. No exposure was found directly along the contact, but the pronounced mineral foliation developed in the hornblende-rich phase near the inferred contact suggests some types of slip movement there. A third major fault may occur along a strong lineament running parallel to the two noted above, between the southern shore of Bamaji Lake and the large islands in the lake. Evidence for the fault is meager, but an increasingly strong mineral foliation and gneissosity are discernible in the biotite trondhjemite as it is approached.

A number of northeast-trending faults and lineaments meet the Bamaji Lake Fault at acute angles, but none were observed to cross it. These faults are commonly recognizable in the field as they have produced marked deflections of foliation and/or original features such as volcanic layering, pyroclastic bedding, etc. They are also obvious from stratigraphic offsets or more commonly abrupt truncations, coincident with strong topographic linear features seen on air photos.

South of Moosetegon Lake a number of major faults and shear zones (shown as lineaments on the accompanying maps) splay off from the Bamaji Lake Fault and cut across the western half of the area in an east-west direction. It is this set of parallel faults and shear zones which give the North Bamaji Lake Intrusion its cataclastic character. There are probably many more faults in this set but for the sake of clarity only those associated with strong topographic lineaments were shown on the accompanying maps. Weak irregular electromagnetic conductors occur subparallel to some of these faults (Palonen and Speed 1977).

In the northern part of the area east of Kaginot Lake, stratigraphic correlation is severely complicated by major sets of northeast and northwest-trending faults. These are not generally recognizable in the field, but they are all strong topographic lineaments which correspond to clear stratigraphic and electromagnetic discontinuities (Palonen and Speed 1977).

Very strong linear features are common in areas underlain by granitoid rocks in the Northern Batholithic Complex and the Bamaji-Blackstone Batholith. Most of these are probably faults, but definitive criteria recognizable on the ground are generally lacking. Northeast-trending lineaments appear to be by far the most numerous in both of these areas, the longest most continuous features trend east to east-northeast.

Minor Structural Elements

PRIMARY PLANAR ELEMENTS

Bedding is evident in most outcrops of clastic and chemical metasediments and in most outcrops of tuff, lapilli-tuff and lapillistone. Contacts between flows are commonly seen on shoreline exposures but they are rarely obvious on inland outcrops. In general these contacts are planar, with minor (<1 m high) irregularities. Discontinuous flow layering was observed in only a few places in intermediate flows in western Fry Lake.

Igneous layering is developed fairly consistently through the biotite trondhjemite phase of the Bamaji-Blackstone Batholith where outcrops consist of concordant layers generally varying only slightly in colour and grain size. The primary origin of the layering is certainly not well established. Indeed a tectono-metamorphic origin for this pervasive planar structure appears just as likely.

Primary igneous layering does undoubtedly occur in some of the mafic intrusions in the north-central part of the area. The most obvious manifestation is a change in the size and/or concentration of plagioclase phenocrysts from layer to layer. Changes in grain size, texture and mineralogy can also be discerned in a few examples, notably the pyroxenitic-gabbroic sill along the southern shore of the northwestern bay of Fry Lake.

FOLIATIONS, SCHISTOSITY GNEISSOSITY

Foliation produced by the flattening and parallel arrangement of original features such as tephra, conglomerate clasts, pillows, amygdules, etc. is common in this region. Flattening of any of these features can be pronounced enough to give the rock a distinct layered appearance. In nearly all cases where bedding or igneous layering is discernible this foliation was parallel or subparallel to it.

This parallelism also holds for mineral foliations which are present in nearly every rock type except the youngest granitoid rocks and those supracrustal rocks which have been most severely recrystallized. Mineral foliation varies greatly in intensity from a weak parallelism of phyllosilicates only, to very strong alignment of all major minerals present in the rock. True schistosity in which over 50 percent of the mineral grains in the rock are aligned is relatively uncommon, occurring consistently only in the metasediments on the northern side of the islands in Bamaji Lake.

Gneissosity is developed to varying degrees throughout the Bamaji-Blackstone Batholith and in several of the sill-like mafic intrusions found along Bamaji Lake.

LINEATIONS

Along the northern side of Bamaji Lake in particular, originally equant or subspherical objects have been tectonically reshaped into flattened cigar-shaped bodies. These are commonly aligned in such a way as to define both linear and planar structural elements. In the highly deformed conglomeratic rocks in the south central part of the area such lineation is well-developed, and is readily seen because of the preferential weathering away of the metawacke matrix. The lineation of tephra in nearby pyroclastic units is less apparent, but can be observed in a few exposures. Measurements show that in this area lineations plunge shallowly toward the northeast parallel to the shoreline and supracrustal contacts.

In the northern part of Bamaji Lake polygonized plagioclase crystals in crystal tuffs and in gneissic metadiorite intrusions show similar lineations. These are generally steeply dipping and are less consistent in their attitudes than the lineations noted above.

Relatively weak mineral lineations were observed in some of the other intrusive rocks in the area. Alignment of hornblende crystals in mafic intrusive rocks was noted in the southern part of Bamaji Lake. Porphyroblasts of quartz form lineations in some of the porphyroidal trondhjemitic rocks around North Bamaji Lake.

Minor outcrop-sized folds do not appear to be common here, but scattered examples occur in all parts of the area, involving virtually all lithologies. The axes of these folds are generally consistent with those of the major folds in the area.

ECONOMIC GEOLOGY

Occurrences of molybdenum, uranium, gold, silver, and copper are known to be present in the map area, but so far none have proven to be of economic size or grade.

Exploration for gold has gone on sporadically here since the mid-1920s with very little success. No prospect ever approached a production stage. During the search for gold, uranium was discovered south of Moosetegon Lake in the mid-1950s. Further prospecting in that area has found several small uranium occurrences and a number of polymetallic base and precious metal showings.

Although minor base metal sulphide showings had been recognized in the area since the 1920s, exploration specifically aimed toward base metals did not begin until the mid-1960s. In large part this was due to the remote location, poor accessibility and paucity of geological information available on the region up to that time. Considerable work was done around Fry, Bamaji, and North Bamaji Lakes between 1966 and 1968. Most of this effort was directed toward locating copper-zinc sulphide mineralization in the metavolcanics north of Bamaji Lake but several molybdenum occurrences were also investigated around North Bamaji Lake and Senior Lake.

Between 1969 and 1974 major exploration programs involving airborne and ground geophysical surveys, systematic prospecting and geological mapping, and considerable diamond drilling were carried out across this part of the Uchi Subprovince by several large companies. Results of this minor "rush" were generally inconclusive, and very little additional work has been reported in the map area and vicinity for several years.

During the period of the current survey, the only mining claims in good standing within the map area were a group south of Moosetegon Lake around the main Bamaji Lake Uranium Occurrence, and a single claim over a gold prospect in northern Fry Lake. Recent demand and high prices for gold, and other metals have prompted renewed interest in the known prospects in this region. Several of these have been re-examined recently.

A more detailed summary of the exploration history of the area is found in the introduction of this report (*see* History of Mineral Exploration). A compilation of reports on mining exploration surveys and diamond drill programs which had been submitted to the Ministry of Natural Resources for assessment credit as of December 31st, 1978 is given in Table 3.

Descriptions of individual occurrences are listed separately in a later section.

Gold

Gold mineralization in this area is known to be associated with: (1) quartz veins and silicified shear zones, and (2) pyrite and uraniferous chemical metasediments.

The two best known vein-type occurrences are located near the south shore of Wesleyan Lake (*see* Tivy Gold Prospect), and on the northern shore of Fry Lake (*see* R. Knappett). In the first case a vertical vein occurs along a sheared east-west-trending contact between a trondhjemitic sill and a fine-grained mafic metavolcanic unit. The vein varies from 1 m to a few centimetres in width and is mineralized with disseminated pyrite, chalcopyrite, galena, and sphalerite. Gold appears to be associated with the sulphide minerals but no visible gold has ever been reported from this site.

In the Fry Lake showing three narrow subparallel steeply dipping, north to northwest-trending quartz veins cut coarsely amphibolitized mafic metavolcanics and metagabbro sills. The quartz contains considerable pyrite and lesser amounts of arsenopyrite and black tourmaline. Magnetitic chemical metasedimentary units are known to occur nearby, but no felsic to intermediate intrusive bodies are present in the vicinity. Again no visible gold has been reported, and in this case gold is believed to be associated with arsenopyrite.

Significant gold assays have been obtained from the Bamaji Lake Uranium Occurrences. In the main showing gold has been found in pyritic muscovite-rich siliceous schist which appears to be a tuffaceous unit, in adjacent units of finely bedded metawacke-mudstone, and to a lesser extent in carbonate-actinolite-biotite rocks which probably represent metamorphosed chemical sedimentary rocks. In all of these units the gold appears to be directly associated with the pyrite, which occurs: (1) disseminated within the tuffaceous unit, (2)

TABLE 3: SUMMARY OF EXPLORATION WORK IN THE SLATE FALLS AREA. INFORMATION ON PROPERTIES GATHERED FROM FILES IN THE ASSESSMENT FILES RESEARCH OFFICE, ONTARIO GEOLOGICAL SURVEY, TORONTO, CURRENT TO DECEMBER 31, 1978.

FILE NAME	CLAIM MAP AREA	PROPERTY REFERENCE NUMBER	A.F.R.O. FILE NO.	TYPE OF WORK REPORTED	YEAR
McCombe Mining and Exploration Limited	Fry Lake	7	10	DH (11 totalling 174 m)	1954
Kirkland Townsite Gold Mines Ltd.	Fry Lake	3	63.2510	GM	1968
Cochenour Willans Gold Mines Ltd.	Fry Lake	1	13,14,15,16,17,18	DH (8 totalling 512 m)	1970
"	Nabemakoseka Lake	1	10	DH (9 totalling 283 m)	1970
"	Wesleyon Lake	1	10	DH (1 for 31 m)	1970
"	Fry Lake	1	2.322	G, EM, MAG	1970
Cochenour Willans Gold Mines Ltd. and Selco Exploration Company Limited	Fry Lake	1	63.2856 63.2865 63.2866	G, HLEM, MAG	1970
Selco Exploration Company Limited	Fry Lake	1	11,12	DH (5 totalling 363 m)	1970
Cochenour Willans Gold Mines Ltd.	Fry Lake	1	19	DH (3 totalling 140 m)	1971
"	Wesleyon Lake	1	11	DH (4 totalling 218 m)	1971
"	Fry Lake	1	2.358 2.690	G, HLEM	1971
Bruce Bell	Fry Lake Wesleyon Lake	11	2.427	IP, G, MAG	1971
Cochenour Willans Gold Mines Ltd.	Fry Lake	1	2.778 2.965 2.1083 20	G, HLEM, MAG DH (2 totalling 100 m)	1972
"	Wesleyon Lake	1	12	DH (1 for 71 m)	1972
Union Miniere Exploration and Mining Corporation Limited	Fry Lake	11	2.1212	A, EM, MAG	1973
Dome Exploration (Canada) Limited	Fry Lake	2	2.1705	G, EM, MAG	1974
Union Miniere Exploration and Mining Corporation Limited	Fry Lake	11	21,22,23,24	DH (4 totalling 230 m)	1974
"	Wesleyc ~ Lake	11	13,14	DH (2 totalling 131 m)	1974

NOTES

A — airborne
DH — diamond-drill hole
EM — electromagnetic survey
HLEM — horizontal loop electromagnetic survey
IP — induced polarization survey
G — ground
GM — geological mapping
MAG — magnometer

in fine conformable layers in the metawacke, and (3) as large irregular clots and coarse disseminations in the calc-silicate material.

In smaller uranium occurrences more or less along strike with the main showing to the southwest, low gold levels have been reported in pyritic actinolite-rich pods and veinlets, and in the immediately surrounding trondhjemitic rocks.

Silver

This metal has been reported in minor amounts along with the gold in the occurrences discussed above, but the Sanderson option is known primarily for its silver potential. Northeast of Slate Falls east-west-trending shear zones parallelled by irregular quartz veins and anastomosing stringers contain erratically distributed sulphide minerals. The main vein is up to 1 m wide but over most of its length of over 300 m it is only a few centimetres in width. Pyrite and chalcopyrite are the most abundant sulphides present but tetrahedrite, sphalerite, pyrrhotite, and galena were also identified. These minerals occur both sparsely disseminated and in irregular pods up to 10 cm in length and 2 to 4 cm wide. Visible gold has been reported there, but silver appears to occur in the tetrahedrite and galena, and possibly in yet unidentified silver sulfosalts. Malachite and azurite are common along shear planes between the mineralized veins and the surrounding mafic metavolcanics.

Copper

Minor chalcopyrite occurs in many of the gold, silver, and molybdenum-bearing quartz vein type deposits in the area. In a few cases it is the dominant sulphide mineral, but invariably tonnages involved are insignificant.

Finely disseminated chalcopyrite along with pyrite occur in the southern part of the North Bamaji Lake Intrusion. Total sulphide content may average as high as 3 percent and locally exceed 5 percent but generally very little of this is chalcopyrite.

Diamond drilling of geophysical anomalies in the northeastern and north-central parts of the area has resulted in the intersection of sulphide-rich zones in several locations[1]. The sulphides occur: (1) disseminated in mudstone-chemical metasediment sequences and graphitic tuffaceous units, (2) as massive beds in those sequences, or (3) as stringers in mafic and intermediate metavolcanics. Pyrrhotite and pyrite are the dominant sulphide minerals in these drill cores but small amounts of sphalerite, chalcopyrite, and galena have been reported in many sections (*see* Cochenour Willans Gold Mines Limited). Similar occurrences have been reported from drilling done along Bamaji Lake.[1]

East of Moosetegon Lake diamond-drill holes have intersected black, banded, nongraphitic slaty units intercalated with a thin siliceous tuff unit[1]. These slaty units which appear to be fine clastic metasediments are reported to contain up to 15 percent total sulphides with combined disseminated chalcopyrite

[1] Assessment Files Research Office, Ontario Geological Survey, Toronto.

+ sphalerite content as high as 4 percent (*see* Cochenour Willans Gold Mines Limited).

Low chalcopyrite and sphalerite content have also been noted from diamond-drill holes drilled through the southern contact of the Fry Lake Stock.[1] There, the mineralization occurs as fine disseminations and as narrow stringers in the same sort of black banded slaty rock referred to above, and in adjacent intermediate pyroclastic rocks.

Molybdenum

Molybdenite has been found in several widely scattered localities in the area, but most of these occurrences, and the only significant discoveries, are found around the southern part of North Bamaji Lake and the south-central part of Senior Lake (*see* Loon Prospect and Senior Lake Occurrences). For the most part in both of these areas the molybdenite is found along with other sulphide minerals in quartz veins intruding sheared trondhjemite or granodiorite. It also occurs finely disseminated within trondhjemitic rocks in a few places along the Cat River between Bamaji and North Bamaji Lakes.

Molybdenite-bearing quartz veins generally contain pyrite as the most abundant sulphide mineral, with highly variable amounts of chalcopyrite, and rarely sphalerite. Variable amounts of tourmaline, epidote, actinolite, and potassium feldspar are also common constituents. With increasing potassium feldspar content some of the veins are gradational into pegmatite dikes which occur in the same localities. Ferromolybdite, limonite, and malachite were noted in some veins.

The mineralized veins occur both subparallel and at high angles to the host rock foliation. Some are quite regular but others are erratic, pinching and swelling, and degenerating into boudinaged lenses. Sulphide mineralization occurs as fine disseminations, narrow seams and veinlets, disseminated clots, and massive lenses. Minor stringers and disseminated flakes of molybdenite can occur for short distances away from the quartz vein in the adjacent rock. In most of the known showings the mineralization has proven to be very local in extent. Only a few veins in any one area appear to be mineralized. Others in the same outcrop, possibly of different age, and origin, are barren of sulphides or contain only pyrite.

Where present, disseminated molybdenite flakes in the trondhjemite country rock occur oriented at high angles to the rock's mineral foliation, suggesting that this mineralization is both postmagmatic in terms of the host rock and posttectonic. Likewise, the predominant occurrence of molybdenite in quartz veins which appear to be genetically related to quartz monzonitic to granitic pegmatite suggests that the mineralizing fluids were introduced after the formation of the trondhjemite at the time of pegmatite dike intrusion. These dikes are almost certainly related to younger more potassic plutons found in the northern and southern parts of the area.

[1] Assessment Files Research Office, Ontario Geological Survey, Toronto.

Uranium

Two types of uranium showings were recognized in this area. One type, typified by the main occurrence on the southern shore of the small lake south of Moosetegon Lake, consists of quite clearly defined beds of clastic metasediments, carbonate-rich chemical metasediments, and related felsic to intermediate pyroclastic rocks. Together these form a sequence at most 10 m thick in a predominantly mafic metavolcanic terrain intruded by numerous porphyritic trondhjemite sills. The second type consist of isolated lenses of actinolite, actinolite-biotite, and actinolite-carbonate material enclosed in trondhjemitic rock. These are found to the west and southwest of the main showing, several occurring approximately along the regional strike with that showing. Some of these lenses are tens of metres long and up to 2 m thick, and strongly resemble the carbonate-rich chemical metasediment seen at the main showing. They are probably the boudinaged highly attenuated remnants of those metasedimentary units. Other showings are little more than veins from 1 to 3 cm wide which occur along crosscutting shear zones. These may represent injections of material remobilized from metasedimentary units when those beds were subjected to heat from intruding trondhjemite, or may be purely hydrothermal in origin.

Radiometric studies and chemical analyses indicate that the uranium and thorium are concentrated only in pyritic and carbonaceous metasediments. Only very low levels of radioactivity, comparable to those encountered elsewhere in the map area, exist in the mafic metavolcanics and trondhjemitic intrusions in the vicinity of the showings. In the main showing the highest uranium and thorium contents occurred in pyritic finely bedded metawacke-mudstone units which contain graphitic clots and disseminated carbonaceous material. Lower concentrations of both uranium and thorium were found in the chemical metasedimentary units, now consisting of actinolite, biotite, dolomite, and calcite, which probably originated as an impure dolostone or limestone.

U/Th ratios in rocks from these showings are quite variable, but generally quite low, from 1:2 to 1:8. Christie (1979) believes that this can best be explained by a hydrothermal synvolcanic origin for the deposits, roughly similar to the Rexpar deposit of British Columbia (Preto 1978). He concluded that uranium and thorium were originally in late-fractionating fluids derived from the magma which produced the local pyroclastic rocks. As these fluids passed through the local strata uranium was selectively deposited in the pyritic carbonaceous units where strongly reducing conditions must have existed suitable for the rapid decomplexing and precipitation of water soluble uranous and/or uranyl species.

Recommendations for Future Mineral Exploration

Although economically significant deposits of uranium in Early Precambrian (Archean) rocks are rare, the potential in this area should not be discounted. There is a strong probability that several known showings east of North Bamaji Lake occur directly along strike, possibly once having formed a single stratigraphic unit. If this is the case, appreciable tonnages may be in-

volved if ore grade mineralization is found. The high gold content of the uraniferous unit is an additional incentive for exploration in the vicinity, in fact the precious metal potential of the property may overshadow that of uranium.

The uranium and gold-bearing zone lies on the south side of an east-northeast-trending anticline which has been outlined in part by a moderately strong positive aeromagnetic anomaly which passes very close to the main showing. This structure indicates that the stratigraphic units of interest may be found between southern Rockmere, and Moosetegon Lakes and south of the northern part of Moosetegon Lake. In the nose of this fold, which appears to be south of the northern part of Moosetegon Lake, thickening of the stratigraphic units may be expected, thus increasing the chances of finding minable quantities of uranium and/or gold.

Airborne radiometric work has proven ineffective in locating the narrow vertically dipping uraniferous zone. Meticulous prospecting will be required to establish the dimensions of the known uranium-bearing unit and to possibly find similar units at different stratigraphic levels in this area, much of which consists of moss-covered discontinuous outcrop. Detailed geological and geochemical mapping may develop a distinct stratigraphic "fingerprint" of the uraniferous zone, and surrounding metavolcanics which may be used as a prospecting tool in other parts of the area.

Graphitic, pyritic mudstone units and other carbon-rich clastic and chemical metasedimentary units were intersected by diamond-drill holes east of Moosetegon Lake. These are potentially similar to the known uraniferous strata, and should be tested for anomalous radioactivity.

The known uranium occurrences are only 500 to 600 m stratigraphically below a major unconformity which is overlain by conglomerates and sandstones. Rocks similar to those of the known occurrences may have been eroded to produce these clastic metasediments, hence reconnaissance prospecting for uranium along the northern shore of Bamaji Lake around the Cat River between Bamaji and North Bamaji Lakes may prove worthwhile.

Disseminated sulphide mineralization (pyrite, and pyrrhotite) is widespread in the trondhjemitic rocks near the southern shore of North Bamaji Lake, however nearly all of the molybdenite, and chalcopyrite found while mapping was restricted to quartz vein occurrences. Where disseminated molybdenite was observed in the country rock the evidence suggested that its formation post-dated the pervasive mineral foliation. Concentration of molybdenite-chalcopyrite occurrences near the southern part of the North Bamaji Lake Intrusion, in and near quartz veins and related pegmatite bodies, may signify that the hydrothermal fluids which produced the mineralization were introduced very much later than the main intrusive event, and that those fluids may have been derived from the younger quartz monzonitic body to the southwest of North Bamaji Lake. If these inferences are correct, the granitoid terrain to the southwest of the map area warrants investigation for this type of mineralization.

Molybdenite-bearing quartz veins in the Senior Lake area also appear to be related to pegmatite intrusions, but their source is not clear. They may be derived from one of the younger potassic phases in the Northern Batholithic Complex. Two small molybdenite occurrences were found by the field party in quartz veins associated with quartz monzonitic to granitic (*sensu stricto*)

phases in the Kezik Lake area.

So far the only significant gold occurrences found in the map area have been those held by R. Knappett on the north shore of Fry Lake, and those associated with uranium south of Moosetegon Lake, which have already been discussed. In the Flicka Red Lake Occurrence (R. Knappett) the gold bearing veins appear to be spatially related to magnetitic chemical metasediments. This and their north-trending strike which is relatively uncommon for quartz veins in the area, may prove useful observations in locating more such occurrences in that part of the area.

Zones of carbonatized mafic metavolcanics found in the eastern and central Fry Lake area should be checked for their gold and silver contents.

Visible sulphide mineralization in the metavolcanics of this area appears relatively sparse. Nevertheless, there are several factors present indicative of an environment potentially favourable for the deposition of synvolcanic base metal sulphide deposits. Intermediate, and felsic pyroclastic rocks, some as coarse as tuff-breccia, are prominent lithologies in the northwestern Fry Lake-Kaginot Lake area. In some cases these rock types form wedge-shaped accumulations, believed to have been topographic domes, overlain by younger mafic to intermediate flows. Massive, and banded sulphidic chemical metasediments have been intersected in drill core around the northern part of Fry Lake. Only low copper and zinc values have been reported from that drilling, but the program has by no means exhausted the possibility of the presence of sizeable ore bodies in that area.

The thin sequence of felsic to intermediate pyroclastic rocks along the northern side of Bamaji Lake is believed by the author to be considerably younger than the Fry Lake metavolcanics. The chemical and metallogenetic characteristics of these two sequences may differ considerably, and the younger sequence may warrant separate investigation for base metal sulphides.

Descriptions of Properties

The descriptions of properties are listed alphabetically as follows:

(1) In the case of claims held as of December 31, 1978, properties are listed in the name of the registered claim holder.

(2) In the case of a known mineral deposit not included in (1), the property is identified by a geographic name, or a historically well-established name for that deposit.

(3) In the case of ground on which there has been appreciable exploration activity but which was not held as of December 31, 1978, and in which no notable mineral occurrences have been found, the properties are listed under the name of the last company or individual to work in that area. In this case the name will be followed by a date in square brackets representing the year in which that work was done.

The number in round brackets following the property name is the property location number which is shown on the accompanying geological maps.

Details of the history of the various properties are taken from company reports on file with the Assessment Files Research Office, Ontario Geological Survey, Toronto; from reports and records of the Ministry of Natural Resources; and from information made available to the author by the companies and individuals concerned.

COCHENOUR WILLANS GOLD MINES LIMITED [1973] (1)

From 1969 to 1973 this company was active in the central Uchi Subprovince including the Slate Falls Area and the Drum Lake Area immediately to the east. Much of the work, which included geological mapping and prospecting, both airborne, and ground electromagnetic and magnetometer surveys, and diamond drilling, was done in a joint venture with Selco Exploration Company Limited known as the Bamaji Project. Prior to this regional effort, in 1966 Cochenour Willans Gold Mines Limited had worked on several known showings within the map area, including the Loon Molybdenum Prospect and the Sanderson Option which are described later in this report under separate headings.

An airborne input electromagnetic and magnetometer survey flown in 1969 was used as a basis for selection of areas in the region warranting ground reconnaissance. In 1970 and 1972 over 450 claims were staked throughout the region, including 15 small claim groups in the map area alone. These claims were covered by horizontal loop electromagnetic surveys and in many cases diamond-drill testing of electromagnetic conductors was carried out. Subsequently, parts of the area were reflown and ground follow-up work continued until early 1973. A total of 4490 m of diamond drilling was done in the map area by the two companies involved between 1970 and 1973.

On the accompanying maps, only the areas tested by diamond drilling have been designated with a property number. The results of the diamond drilling were generally disappointing with only low copper-zinc values reported in a few holes. No activity has been reported in the area by either company since 1973.

DOME MINES LIMITED - DOME EXPLORATION (CANADA) LIMITED [1974] (2)

In 1965 a small group of claims immediately east of the northeastern end of North Bamaji Lake was optioned by Dome Mines Limited and its subsidiaries Campbell Red Lake Mines Limited and Sigma Mines (Quebec) Limited. Prospecting and trenching on the property in 1966 found sub-economic amounts of gold and silver in quartz veins and the claims subsequently lapsed.

In 1974 Dome Exploration (Canada) Limited performed a combined ground magnetometer and electromagnetic survey over an area which included the old property, but no further work was reported.

KIRKLAND TOWNSITE GOLD MINES LIMITED [1968] (3)

An airborne spectrometer survey commissioned by this company, was flown over the Bamaji Lake Uranium Occurrences east of North Bamaji Lake in 1968. Most of that area is currently held by Urangesellschaft Canada Limited. A geological mapping program emphasizing structural interpretation was done in the same year. Prospecting, trenching, and sampling were carried out across the property and a number of small uranium-gold occurrences were outlined over a length of 1160 m in what was termed a "sheared transition" between trondhjemitic and metavolcanic areas (Underhill 1968).

Assays reported from the showings range from trace to 0.49 percent U_3O_8 and from trace to 0.50 oz/ton gold (Underhill 1968).

KNAPPETT, R. (FIICKA RED LAKE PROSPECT) [1947](5)

As of December 31st, 1978, Mr. R. Knappett held a single claim which included the gold occurrences on the northern shore of the large western bay of Fry Lake which has been commonly referred to as the Flicka Red Lake Prospect.

HISTORY

The occurrence was originally discovered in 1935 by Connell Mining and Exploration Company Limited. Harding (1935) reported an assay of 0.22 oz/ton gold from a sample of mineralized quartz from the showings. In 1945 Flicka Red Lake Gold Mines Limited acquired the property by staking 16 claims around it, and, after a preliminary survey of the veins exposed by stripping in 1935, an exploration program including trenching and diamond drilling began which continued into 1947. Altogether 14 diamond-drill holes were put down. All but one of these holes tested the area around the original discovery, and the other was drilled over a shear zone across the lake on the eastern side of the bay. Despite encouraging results from several of these holes no further work was reported after 1947.

GEOLOGY

The three main gold bearing veins on the property are subparallel and similar in appearance. They occur over a distance, perpendicular to strike, of about 100 m. Strike is northward and dips are to the east at 55° to 65°. All three extend from the lakeshore into heavy overburden at their northern end. The longest is exposed for about 30 m but diamond drilling has confirmed its extension for at least 50 m to the north. Widths vary from a few centimetres to more than 1.5 m in places.

The country rock is coarse metagabbro which forms a sill intruding intermediate flows and pyroclastic rocks, coarse clastic metasediments, and magnetitic chemical metasediments. Adjacent to the mineralized quartz veins the metagabbro is generally rusty, highly sheared, and shot with fine quartz stringers.

Several northeast and east-trending shear zones and minor faults are known in the immediate area. Some of these are strongly carbonatized, others are silicified and contain sulphides forming up to several percent of the rock. Two of these zones were explored by diamond drilling and were found to contain appreciable (several assays over 1.0 oz gold/ton) but highly erratic gold values (Cumming 1945).

MINERALIZATION

The three main veins consist of coarse white quartz with uniformly disseminated pyrite, arsenopyrite, and tourmaline. Gold values were reported from the mineralized quartz and from the sheared contacts with the metagabbroic country rock including rusty quartz stringers (Cumming 1945). It was suggested by Cumming that the gold was associated with the arsenopyrite, but there was little direct evidence for that hypothesis.

The best exposed vein, known as the No.3, gave the highest assay results from both channel samples and diamond-drill core. Results of 0.23 oz of gold/ton over 160 cm, and 0.18 oz of gold/ton over 140 cm were reported at the northern end of that vein. A 60 cm length of core from a drill hole which intersected the same vein at a vertical depth of 12 m assayed 1.12 oz of gold/ton (Cumming 1945).

Four drill holes intersected a northeast trending mineralized shear zone located about 60 m north of the No. 3 vein. In core from one hole 9.14 oz of gold/-ton were reported over 50 cm, and in another 0.25 oz of gold/ton were found over 60 cm. Results from the other holes were much lower, 0.06 oz of gold/ton over 50 cm and 0.10 oz of gold/ ton over 40 cm.

The drill hole which intersected the shear zone on the eastern shore of the bay gave best results of 0.70 oz of gold/ton over 23 cm and 0.33 oz of gold/ton over 67 cm.

Figure 6 is a sketch map of the ground investigated by Flicka Red Lake Gold Mines Limited.

KNAPPETT SILVER OCCURRENCE (4)

A small silver occurrence located south of the easternmost extremity of North Bamaji Lake was found by Mr. Knappett in 1971. The occurrence consists of disseminated sulphides, mostly pyrite and chalcopyrite, in a shear zone in mafic metavolcanics. Very little work has been done on the site. The best assay reported gave 0.38 oz of silver/ton and 0.39 percent copper (Sage and Breaks 1976).

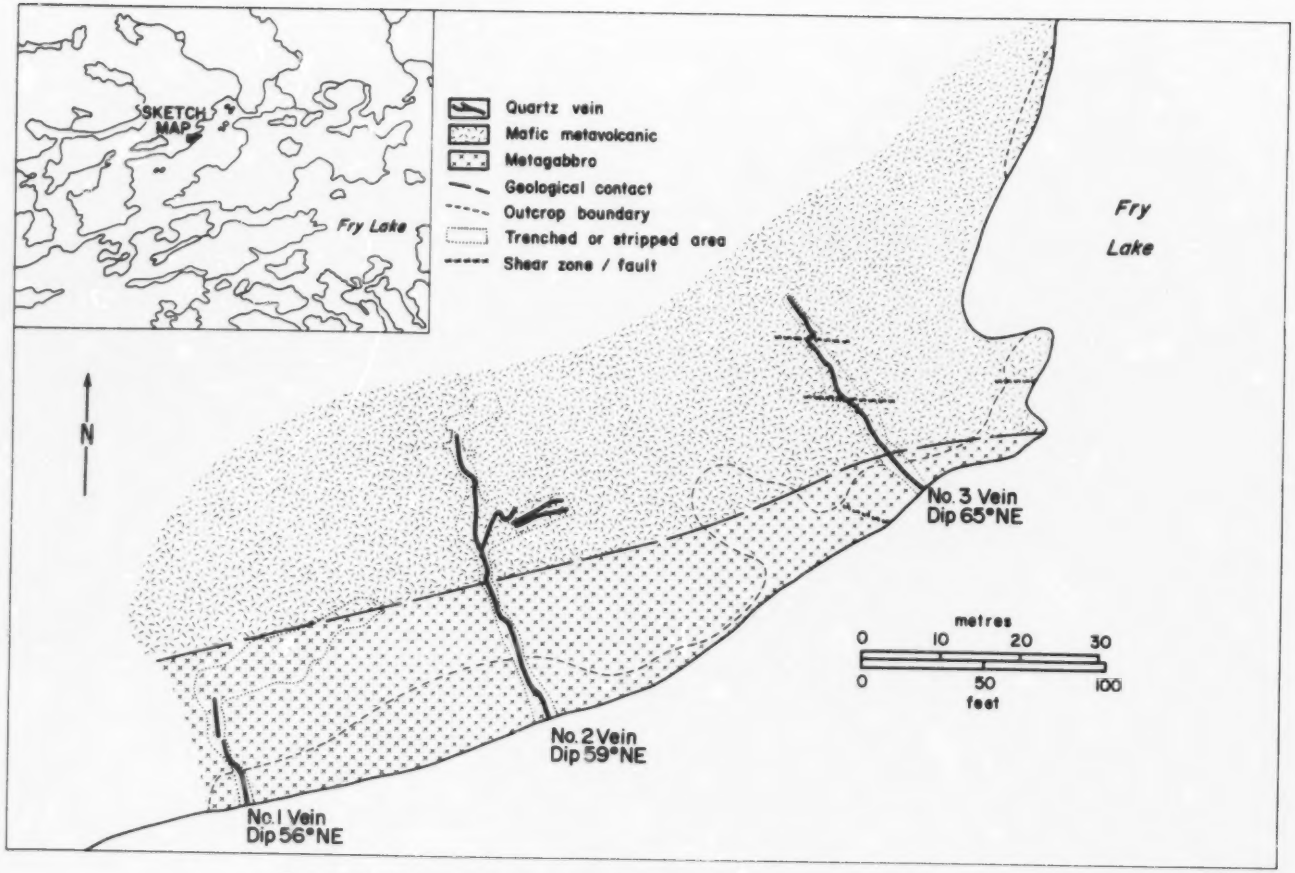


Figure 6–Sketch map of the Flicka Red Lake Gold Occurrence (after Cumming 1945).

SMC 15200

LOON MOLYBDENUM PROSPECT (6)

This deposit, which includes several showings located on the northern shore of the largest island in North Bamaji Lake, is by far the most significant of the molybdenum occurrences in this area.

HISTORY

The prospect was first discovered and staked by the Loon family of Slate Falls in the early 1960s. In 1965 the claims were jointly optioned by Cochenour Willans Gold Mines Limited and Coin Lake Gold Mines Limited, and a program of stripping, trenching, geological mapping, and diamond drilling continued on the property and at several smaller molybdenum showings around North Bamaji Lake through 1966. Altogether 12 diamond-drill holes totalling 784 m were put down. Nine of those were around the main showing (*see* Figure 7) and the others tested smaller showings to the east. The results of the drilling were generally disappointing, indicating overall low grade mineralization almost entirely restricted to the quartz veins visible at the surface.

GEOLOGY

Sulphide mineralization occurs in a complex series of quartz veins and discontinuous lenses, and to a minor extent in the adjacent country rock which is sheared recrystallized leucocratic biotite trondhjemite. The quartz veins are subvertical and strike at between 75° and 85°. Trondhjemite directly adjacent to the veins is typically highly schistose, and rich in sericite. The contacts vary from sharp to gradational even along the length of individual veins, and the veins tend to be very irregular in terms of both size, and shape.

At the main showing the largest vein pinches and swells in an *en echelon* manner over an exposed length of 13 m reaching a maximum width of 1 m. This and other smaller veins nearly change orientation, erratically varying from subparallel to highly discordant with respect to the strong east-west foliation of the trondhjemite.

The veins consist of white (locally rust stained), highly strained polygonized quartz. Besides the sulphide minerals discussed below they commonly contain variable amounts of coarse-grained biotite, fine- to coarse-grained actinolite, epidote, and black prismatic tourmaline. Some veins also contain several percent pink microcline, and as suggested earlier in this report (*see* Southern Pegmatite *in* Felsic to Intermediate Intrusive Rocks) these are probably transitional between the local pegmatite dikes and normal quartz veins.

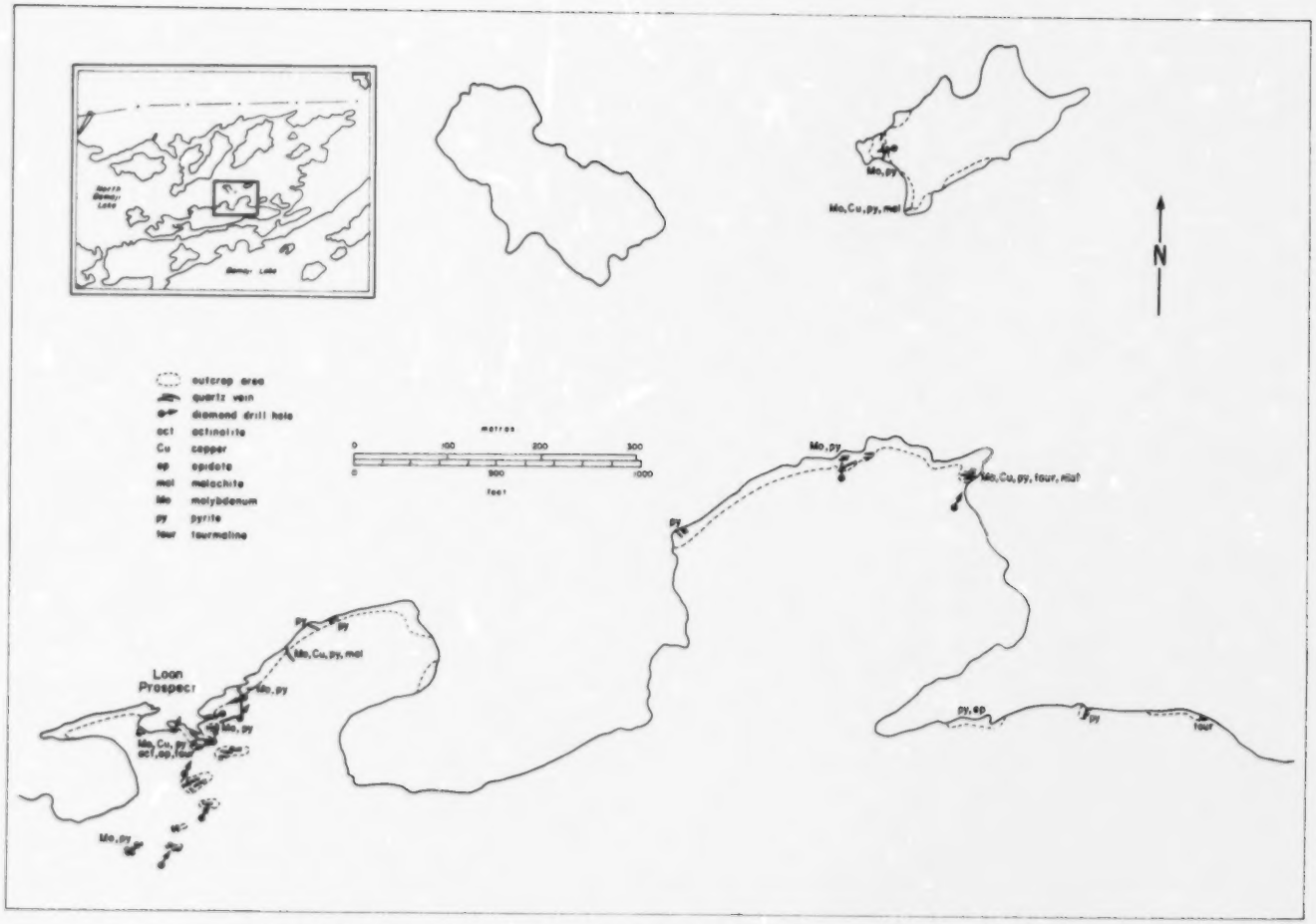


Figure 7–Sketch map of the area surrounding the Loon Molybdenum Occurrence (after Hutton 1966).

SMC 15201

MINERALIZATION

Molybdenite occurs within the quartz veins along with abundant disseminated and massive pyrite, and sparsely distributed chalcopyrite. Ferromolybdite, limonite, and malachite are common alteration products present in several localities. The molybdenite itself forms fine- to very fine-grained disseminations in blue-grey quartz, and also occurs in narrow seams and veinlets, and in massive clots up to 3 cm in diameter. Minor molybdenite stringers and disseminations are also found in the adjacent country rock.

The amount and type of sulphide minerals present vary markedly within and between individual veins. In the best mineralized examples molybdenite forms up to 5 percent of the vein material. Sage, and Breaks (1976) reported results of assays for four grab samples of mineralized vein material ranging from 0.05 to 3.28 percent molybdenum and from 0.45 to 2.91 percent copper. One sample assayed contained 0.18 oz of gold/ton and another contained 9.49 oz of gold/ton (Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto).

Assays done on drill core from the main showing were generally less than 0.12 percent molybdenum. Core from one hole gave results of 1.44 percent molybdenum over 80 cm, and a 1 m section from another averaged 0.33 percent molybdenum (Hutton 1966).

The overall results were rated sub-economic (Hutton 1966). The veins were deemed too small, too widely separated, and of too low combined metal content to be considered mineable.

McCOMBE MINING AND EXPLORATION LIMITED [1954] (7)

In 1953 this company staked a block of ten claims south of Moosetegon Lake around two of the Bamaji Lake Uranium Occurrences. The following year the showings were stripped and trenched, and eleven shallow diamond-drill holes totalling 172 m were put down along the strike of the main occurrence which is now held by Urangesellschaft Canada Limited.

SANDERSON OPTION (8)

This silver-gold occurrence, which consists of a mineralized quartz vein system occupying an east-west shear zone at least 500 m long, is located about 5 km northeast of the community of Slate Falls. In 1966 Cochenour Willans Gold Mines Limited did considerable work on several small showings along the quartz veins. Stripping and trenching were done in several places along the strike of the shear zone, and nine diamond-drill holes totalling 451 m were drilled (Assessment Files Research Office, Ontario Geological Survey, Toronto).

Slate Falls Area

GEOLOGY

On this property east-trending, vertically dipping quartz veins fill shear zones which cut mostly mafic flows and minor irregular intrusions of porphyritic biotite trondhjemite. The quartz veins are highly irregular in shape, typically breaking up into lenses and anastomosing stringers along strike. The main veins, which are traceable for about 300 m along strike, are generally less than 20 cm in width and rarely exceed 1 m.

MINERALIZATION

Sulphide minerals, notably pyrite, sphalerite, chalcopyrite, and galena, as well as azurite, occur finely disseminated or as small irregular pods (1 to 2 cm across) in the quartz veins, and appear to be concentrated near the contacts with the surrounding sheared metavolcanics. Total sulphide mineral content is in the order of 2 to 5 percent, with pyrite being by far the most abundant. Tetrahedrite, and visible gold have also been reported from some trenches and drill core (Sage and Breaks 1976).

Two grab samples of mineralized vein material were selected for assay by Sage and Breaks (1976). One gave 3.70 oz of silver/ton, 0.04 oz gold/ton, 0.27 percent copper, and only traces of lead and zinc. The other contained 34.41 oz of silver/ton, 0.47 oz of gold/ton, 1.49 percent copper, and 0.82 percent lead.

Assays of diamond-drill core intersections of the mineralized zone confirmed that pockets of spectacular silver-gold occurred in several places along the length of the shear zone-quartz vein system, but "the mineralization appeared to be irregularly distributed and confined to relatively narrow widths" (Sage and Breaks 1976).

SENIOR LAKE MOLYBDENUM OCCURRENCES (9)

Several small molybdenite showings are known on the shores of Senior Lake near the western boundary of the map area.

The following description is taken from a recent report by Sutherland (1978):

> Molybdenite occurs in numerous, small showings along the northeast and southwest shores of Senior Lake. The largest of these showings is located at the entrance to the large bay to the north-central region of Senior Lake. It consists of a mineralized quartz vein that occupies the intrusive contact between a fine to medium grained 'felsite' to the south and a weakly foliated to unfoliated, epidote-biotite trondhjemite to granodiorite to the north. The 'felsite' is mineralized with fine grained, disseminated pyrite, and is cut by tiny epidote stringers. Both of the intrusive phases are cut by minor dikelets of coarse grained to pegmatoid quartz monzonite. The quartz vein is about 20 cm at its widest and best mineralized location and it pinches out to the east and west. Molybdenite mineralization of locally up to 15 percent MoS_2 occurs as disseminations, banded disseminations, small stringers, and paint, primarily within the quartz vein with disseminated pyrite. Pyrite occurs in varying amounts over the entire exposed length of the quartz vein (approximately 25 m) but

the presence of molybdenite is restricted to only about 5 m of the vein.

The two neighbouring outcrops to the north and south host small irregular quartz veins with minor disseminated pyrite, especially along the borders, and traces of disseminated molybdenite. The country rocks are the same weakly foliated biotite trondhjemite to granodiorite.

Four, adjacent occurrences are present to the northeast of the same large bay along the northwestern shore. Minor pyrite, and traces of molybdenite ± chalcopyrite occur in small, irregular quartz-potassium feldspar veins or lenses. The host rock is a weakly foliated biotite trondhjemite to granodiorite with a few, small, mafic inclusions that is cut by 'felsite' dikes of variable width, many of which are pyritic, pegmatoid, quartz monzonite dikes, and pyritic to barren quartz veins.

Along the southern shore of Senior Lake, due east of the previous showings, a small occurrence of molybdenite in a quartz vein system was found, hosted in a weakly foliated, biotite-rich (locally chloritized), trondhjemite to granodiorite. The host rock foliation of S70E is cut by an easterly trending, mineralized, quartz-epidote-chlorite vein of 2 to 5 cm in width and of irregular shape with a few small, branching veinlets. Fracture controlled epidote veinlets and stringers are also present with abundant iron and possibly silica metasomatism adjacent to them. Fine to medium grained, disseminated cubes of pyrite, and disseminations and disseminated clots of molybdenite are restricted to the quartz vein material. Molybdenite is present in amounts up to 2 percent but this mineralization is very localized in extent, and many nearby quartz veins are essentially barren of any sulphides.

TIVY GOLD PROSPECT (CONNELL-STIRRETT-WILLIAMS GROUP) (10)

In 1927, P. Tivy staked a small gold showing just south of Wesleyan Lake (Laird 1930), but little work was done at that time. Part of that area was restaked in 1934 by A.B. Connell, T.H. Stirrett, and S. Williams (Harding 1935); and stripping and trenching were done along an east-trending quartz vein exposed intermittently for roughly 800 m along strike. The vein is mineralized with pyrite, chalcopyrite, pyrrhotite, and galena; and occurs along a shear zone between a mafic flow and a sill-like lense of trondhjemite. Width varies up to about 2 m but the vein is generally less than 50 cm wide.

A grab sample of mineralized material collected by Harding (1935) assayed 0.15 oz of gold/ton but he indicated that gold values as high as 0.5 oz of gold/ton had been obtained from the main showing.

In 1971 Cochenour Willans Gold Mines Limited put down four diamond-drill holes in the general vicinity of the old Tivy Gold Prospect. These investigated coincident electromagnetic and magnetic anomalies in metavolcanic terrain, and although thin zones of massive sulphide were found, only traces of copper and zinc were reported (Assessment Files Research Office, Ontario Geological Survey, Toronto).

UNION MINIERE EXPLORATION AND MINING CORPORATION LIMITED [1974] (11)

In 1973 this company commissioned an airborne electromagnetic survey which covered most of the present map area. Diamond drilling of several anomalies north and east of Rockmere Lake, and in the northeastern corner of the map area took place in 1974, but no significant base metal discoveries were reported (Assessment Files Research Office, Ontario Geological Survey, Toronto) and claims staked in 1973 were allowed to lapse.

URANGESELLSCHAFT CANADA LIMITED (BAMAJI LAKE URANIUM OCCURRENCES) (12)

As of December 31st, 1978, this company held a block of 23 contiguous claims which included all of the known uranium showings in the area between Moosetegon, Bamaji, and North Bamaji Lakes.

HISTORY

The main uranium-thorium showing, located on the southern shore of the small lake known as Don's Lake south of Moosetegon Lake, was first discovered in 1954 by McCombe Mining and Exploration Limited. During 1954 that company trenched and sampled the showing, and put down 11 diamond-drill holes, totalling 172 m, equally spaced along the mineralized zone. The results of the drilling were generally disappointing in terms of uranium and gold, and the ground was dropped.

In 1968 Kirkland Townsite Gold Mines Limited acquired a block of claims which included the main showing and several minor showings located to the west. More trenching was done at that time, and a detailed geological map of the vicinity was prepared. Later that year an airborne radiometric survey was flown over the immediate area of the showings but no anomalies were found.

R. Knappett restaked this area in 1971 and continued prospecting for gold and uranium with some success between 1971 and 1977. In 1978 the property was optioned by Urangesellschaft Canada Limited who performed an airborne radiometric survey over the main showing, and did considerable ground work including prospecting, trenching, and geochemical sampling before the winter of 1978-1979.

GEOLOGY

The geology of the main occurrence is depicted in Figure 8. The uranium-thorium-gold mineralization occurs in a sequence of rhyolitic pyroclastic rocks, chemical metasediments, and metawacke-mudstones totalling no more than 7.5 m in thickness and presently exposed along strike for at least 150 m. The stratigraphy to the north and south of this sequence consists almost entirely of fine to medium grained, commonly pillowed mafic amphibolites, intruded by numerous fine to medium grained aphyric and porphyritic trondhjemite sills from a few centimetres to several tens of metres in thickness.

Although several minor folds were observed in the local metavolcanics and metasediments, the rocks appear to face uniformly southward. The main occurrence is interpreted as being on the southern limb of the Moosetegon Lake Anticline. Consequently the strata described may be expected to recur around that structure, possibly through the central part of Moosetegon Lake, and the area south of Rockmere Lake.

The oldest units in the mineralized sequence are exposed at the north ends

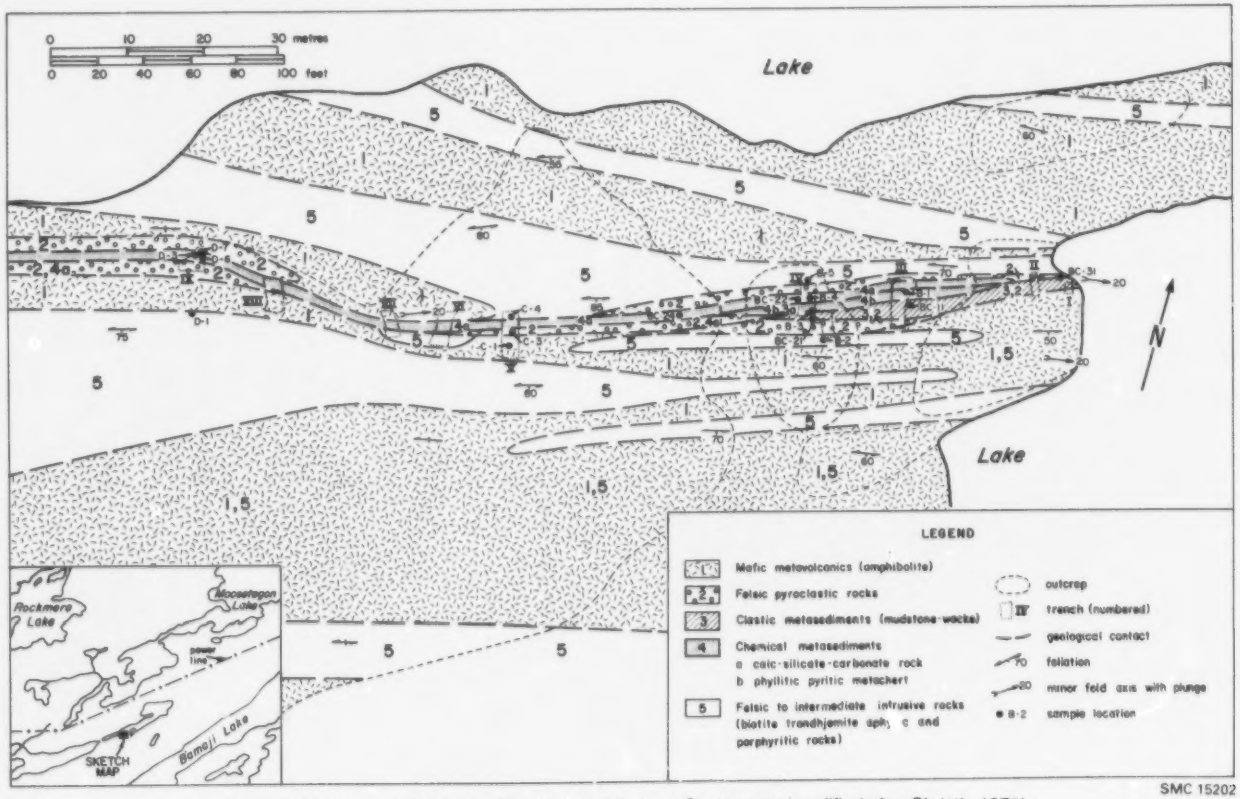


Figure 8–Sketch map of the main Bamaji Lake Uranium Occurrence (modified after Christie 1979).

of trenches IX and IV. At trench IX the unit appears to be a rhyolitic to rhyodacitic lapilli-tuff of unknown thickness which has been highly folded. In trench IV the oldest rock is a white weathering rhyodacitic lithic tuff. Because of shearing in this area, this tuff is difficult to distinguish from the trondhjemitic rocks found just to the north, but small lapilli-sized fragments can still be discerned in the pyroclastic rock. In both trenches mentioned, the pyroclastic rocks give low radiometric readings comparable to those obtained in other parts of the region far from the occurrences.

To the south, these pyroclastic rocks are overlain by a calc-silicate carbonate unit. Where this contact is well-exposed in trenches IX, IV, and III, it is very sharp and forms a regular surface. The calc-silicate carbonate rock, which is believed to represent a metamorphosed chemical sediment such as a "dirty" dolostone, now consists of highly variable amounts of ankeritic dolomite, calcite, actinolite-tremolite, biotite, and chlorite. The silicate occurs in patchy aggregates which tend to form a vague layering parallel to the contacts with underlying and overlying units. This layering may represent relict bedding. Christie (1978) believes this unit to be approximately constant in thickness at 1.0 to 1.5 m. Pyrite occurs disseminated as large crystals (2 to 4 mm) and small pods in both the calc-silicate clots and surrounding carbonate. Radiometric results from this rock type were highly variable, reflecting the great inhomogeneity in terms of silicate to carbonate ratio found across the unit. Generally, the highest radiation counts corresponding to U and Th mineralization were obtained on actinolite-rich lenses low in pyrite. A chemical analysis of a sample of this calc-silicate carbonate material is given in Table 4.

The rock described above is in sharp conformable contact with overlying units, but that contact appears to be quite irregular in some places. At least two distinct units were found overlying the calc-silicate carbonate rock. In the west, the pyroclastic unit(s) consist(s) of buff coloured, dacitic, lithic crystal tuff to fine lapilli-tuff which has several thin (1 to 3 cm) intercalations of actinolite-rich calc-silicate material at intervals of 5 to 30 cm. These rocks are best exposed in trench IX and between trenches IV and V. The contacts between the tuffaceous rocks and the calc-silicate intercalations which contain virtually no carbonate, are very sharp and planar.

In the eastern part of the area included by the sketch map (Figure 8), the calc-silicate carbonate unit is overlain by a white, highly siliceous micaceous bed containing 5 percent finely disseminated pyrite. The bed is typically fissile, and stained with jarosite, and limonite. A chemical analysis of this rock is provided in Table 4. The very low Na_2O, MgO, CaO, K_2O, Ba, Rb, Sr, and Zr contents of the rock tend to preclude a volcanic origin for the unit. It is probably best interpreted as metachert derived as a chemical precipitate similar to the underlying calc-silicate carbonate rocks. Radiometric analyses of this metachert unit shows it to be highly variable in uranium and thorium contents, but results were generally low except in very minor (<2 cm thick) intercalations of mudstone (Christie 1979) which were markedly enriched in those elements.

To the south of this siliceous unit, in trenches II, III, and IV, there is a sequence of finely bedded pyritic and graphitic metawacke-mudstone units which reach a maximum exposed thickness of 2 m in trench III. Very thin layers (2 mm thick) rich in fine euhedral pyrite parallel the bedding. The rock is hard and siliceous, but very dark in colour. Fine graphite is concentrated in subcon-

TABLE 4: ANALYSES OF CHEMICAL METASEDIMENTS FROM THE MAIN BAMAJI LAKE URANIUM OCCURRENCE, SLATE FALLS AREA. ANALYSES BY GEOSCIENCE RESEARCH LABORATORIES, ONTARIO GEOLOGICAL SURVEY, TORONTO.

MAJOR COMPONENTS	A Pyritic metachert	B Calc-silicate carbonate rock
	(weight percent)	
SiO_2	79.8	28.9
Al_2O_3	7.25	2.19
Fe_2O_3	4.74	1.24
FeO	0.23	4.65
MgO	0.18	15.1
CaO	0.13	21.6
Na_2O	0.01	0.00
K_2O	1.21	0.00
TiO_2	0.46	0.12
P_2O_5	0.04	0.05
S	3.65	0.09
MnO	0.0[illegible]	0.27
CO_2	0.04	23.0
H_2O+	0.40	1.00
H_2O	0.30	0.30
Total	98.4	98.5
TRACE ELEMENTS	(ppm)	
Ba	80	50
Co	10	7
Cr	70	5
Cu	6	30
Li	3	4
Ni	10	9
Pb	160	40
Rb	10	10
Sr	10	40
Y	10	10
Zn	15	55
Zr	10	10

cordant streaks, and also occurs disseminated throughout the beds. Scintillometer readings in this sequence were far higher than those obtained from any of the other rock units in the area.

Along most of the exposed length of the metasedimentary sequence, those rocks are overlain by more dacitic to rhyolitic tuff units. These units are generally light grey, fissile, phyllitic, and sulphide-poor; and like the pyroclastics on the northern side of the metasediments, they can easily be confused with sheared trondhjemitic intrusions. Elsewhere the metasediments are directly overlain by fine-grained mafic amphibolite, or are in contact with intrusive trondhjemitic sills or lenses.

About 600 m to the west of the main occurrence a second area of uranium-thorium mineralization has been tested by several small trenches. Sage, and Breaks (1976) have described this occurrence as follows:

> The number two showing is situated along the contact of amphibolitized mafic metavolcanics and trondhjemitic rocks of the Bamaji Lake Complex. The immediate host rock consists of leucocratic medium-grained creamy-weathering, massive to foliated, equigranular to local porphyritic trondhjemite. Quartz phenocrysts up to 5 mm diameter are especially prominent near the mineralized zone. Foliation within the host trondhjemite becomes perceptibly more intense as the shear zone is approached.
>
> ....the mineralization is confined to a 2 foot wide shear zone trending about N80°E and dipping 40°N. Thin actinolite-biotite laminae appear to be controlled by shears *en echelon* within this zone. Individually, these laminae, which rarely exceed 4 cms width and average about 1 cm, are typified by a crude mineralogical zonation. Actinolite tends to dominate although a thin carapace of fine-grained biotite, and disseminated pyrite is invariably present. Usually a dark brown alteration halo occurs immediately adjacent to these veinlets. Disseminated fine-grained pyrite(?) appears to gradually increase to 5-10 percent as these veinlets are approached.

A third type of uranium occurrence is typified by a deposit roughly 2000 m southwest of the main occurrence. This consists of a lens of calc-silicate carbonate material completely surrounded by trondhjemite of the North Bamaji Lake Intrusion. The calc-silicate rich lens is a maximum of 3 m thick, and can be traced for only about 15 m in this poorly exposed area. Large xenoliths of mafic metavolcanic rock of similar dimensions are also common in this part of the area. The calc-silicate unit consists essentially of coarse actinolite, quartz, and calcite. The rock is quite massive but a weak layering parallels the strike of the lens at roughly N75E. Again radiometric results across and along this lens were highly variable. Some scintillometer readings were in fact higher than the highest readings obtained from the clastic metasediments of the main occurrence.

MINERALIZATION

Scintiliometer readings significantly above background levels for uranium and thorium were obtained from calc-silicate carbonate rocks, from pyritic metachert, and from pyritic, graphitic metawacke-mudstones. Autoradiograph studies of these rocks showed that the uranium-thorium-bearing mineral phases were very finely disseminated. Pitchblende, the microcrystalline form of the uraninite series was identified by powder camera X-Ray techniques

TABLE 5: A SUMMARY OF ANALYTICAL DATA AVAILABLE FROM THE BAMAJI LAKE URANIUM OCCURRENCES, SLATE FALLS AREA. LOCATION OF ANALYSED SAMPLES, WHERE AVAILABLE, ARE SHOWN IN FIGURE 8.

SAMPLE	REFERENCE/ ANALYST	ROCK TYPE	U ppm	Th ppm	Au oz/ton	Ag oz/ton	SiO_2 weight	Fe_2O_3 percent
I								
C-1	Wallace (1980)	mafic amphibolite	0.3	—	—	—	50.7	13.2
C-3	"	pyritic rhyolite tuff	7.3	—	—	—	76.2	4.52
BC-11	Christie (1979)	rhyolite tuff	4.3	12.0	—	—	—	0.55
BC-31	"	rhyolite tuff	3.7	4.5	—	—	—	2.89
B-3	Wallace (1980)	phyllitic pyritic metachert	90.0	—	—	—	72.6	8.19
G9-14	Sage & Breaks (1976)	"	848.0	440.0	0.20	Tr	—	—
G9-15	"	"	17.0	440.0	0.06	0.15	—	—
A-1	Wallace (1980)	calc-silicate carbonate rock	8.0	—	—	—	38.4	6.31
B-4	"	"	8.9	—	—	—	25.5	5.72
D-3	"	"	42.2	—	—	—	69.3	1.79
D-6	"	"	20.7	—	—	—	29.5	4.78
D-7	"	"	3.8	—	—	—	30.8	4.78
BC-22	Christie (1979)	"	3.9	—	—	—	—	6.12
BC-24	"	"	11.4	—	—	—	—	7.33
B-2	Wallace (1980)	biotite trondhjemite	1.7	—	—	—	68.0	4.61
B-5	"	"	1.0	—	—	—	68.5	2.90
C-4	"	"	1.1	—	—	—	69.5	2.26
D-1	"	"	0.9	—	—	—	70.31	1.96
BC-21b	Christie (1979)	banded pyritic graphitic mudstone	228.6	523.2	—	—	—	9.61
II								
G-9-22	Sage & Breaks (1976)	actinolite-biotite-pyrite veinlet	34.0	440.0	0.04	—	—	—
G9-23	"	pyritic biotite trondhjemite	51.0	615.0	0.02	—	—	—
III								
TR-3	Wallace (1980)	biotite trondhjemite	0.7	—	—	—	65.9	2.82
TR-3B	"	"	0.9	—	—	—	69.5	2.02
TR-3-C	"	actinolite-quartz-carbonate rock	143.0	—	—	—	44.4	7.00
TR-3D	"	"	2.7	—	—	—	45.7	7.25
TR-3E	"	"	383.0	—	—	—	46.0	8.62

NOTES

I Samples analysed from main uranium occurrence.
II Samples analysed from occurrence 600 m west of main occurrence.
III Samples analysed from occurrence 2000 m southwest of main occurrence.

Tr = trace amount
— = not determined

(Geoscience Laboratories, Ontario Geological Survey, Toronto). No other significantly radioactive mineral was found in samples from this area.

Comparison of some of the autoradiographs with the samples from which they were derived reveals, particularly in the metawacke-mudstones, that the pitchblende occurs mostly in narrow lenses of soft, black material probably rich in graphite. On the other hand, lenses of the rock rich in sulphides contained very little radioactive material.

Few analytical results are available from the Bamaji Lake uranium-thorium-gold occurrences. Table 5 summarizes the information currently available. As expected, the highest uranium content from the main occurrence was obtained from the metawacke-mudstone sequence. In fact, what is probably the highest grade material in terms of both uranium and gold, was only exposed in the southern part of trenches III and IV when those trenches were cleaned out and extended by Urangesellschaft Canada Limited in the fall of 1978 and summer of 1979. Semiquantitative scintillometer measurements on selected samples of the metawacke-mudstone from those trenches indicated equivalent U_3O_8 values of between 0.10 and 0.20 percent. No assay results were available to the author at the time this report was completed.

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LEGEND

PHANEROZOIC

CENOZOIC[a]

QUATERNARY

PLEISTOCENE AND RECENT

Till, sand and gravel (ground moraine and esker deposits).

UNCONFORMITY

PRECAMBRIAN[bc]

EARLY PRECAMBRIAN (ARCHEAN)

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

- *6 Unsubdivided.*
- *6a Foliated, leucocratic, biotite trondhjemite, gneissic.†*
- *6b Massive to moderately foliated, hornblende, biotite-hornblende trondhjemite, quartz diorite, xenolithic.†*
- *6c Foliated, leucocratic, biotite trondhjemite, cataclastic and porphyritic.*
- *6d Biotite, hornblende-biotite quartz monzonite, granodiorite.*
- *6e Feldspar-quartz porphyry, quartz porphyry.*
- *6f Quartz-feldspar porphyry, feldspar porphyry.†*
- *6g Pegmatite, aplite (minor quartz monzonite dikes and sills).*
- *6h Non-porphyritic felsite (minor fine-grained trondhjemite dikes).*
- *6j Hornblende granodiorite, syenodiorite, porphyritic and foliated.†*
- *6k Equigranular, leucocratic, biotite trondhjemite, massive to weakly foliated.*
- *6m Massive, equigranular, biotite granodiorite.*
- *6n Massive, biotite quartz monzonite.*
- *6p Massive, porphyritic, biotite trondhjemite.*
- *6q Massive, porphyritic, biotite granodiorite.*
- *6r Massive, porphyritic, biotite quartz monzonite.*

INTRUSIVE CONTACT

METAMORPHOSED MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

- *5 Unsubdivided.*
- *5a Massive gabbro.*
- *5b Porphyritic gabbro.*
- *5c Schistose to gneissic gabbro.*
- *5d Schistose to gneissic diorite, quartz diorite.†*
- *5e Granoblastic ultramafic amphibolite (metapyroxenite).†*
- *5f Lamprophyre.*
- *5g Peridotite.†*
- *5h Fine-grained, equigranular or porphyritic andesite.*

INTRUSIVE CONTACT

METAVOLCANICS AND METASEDIMENTS[d]

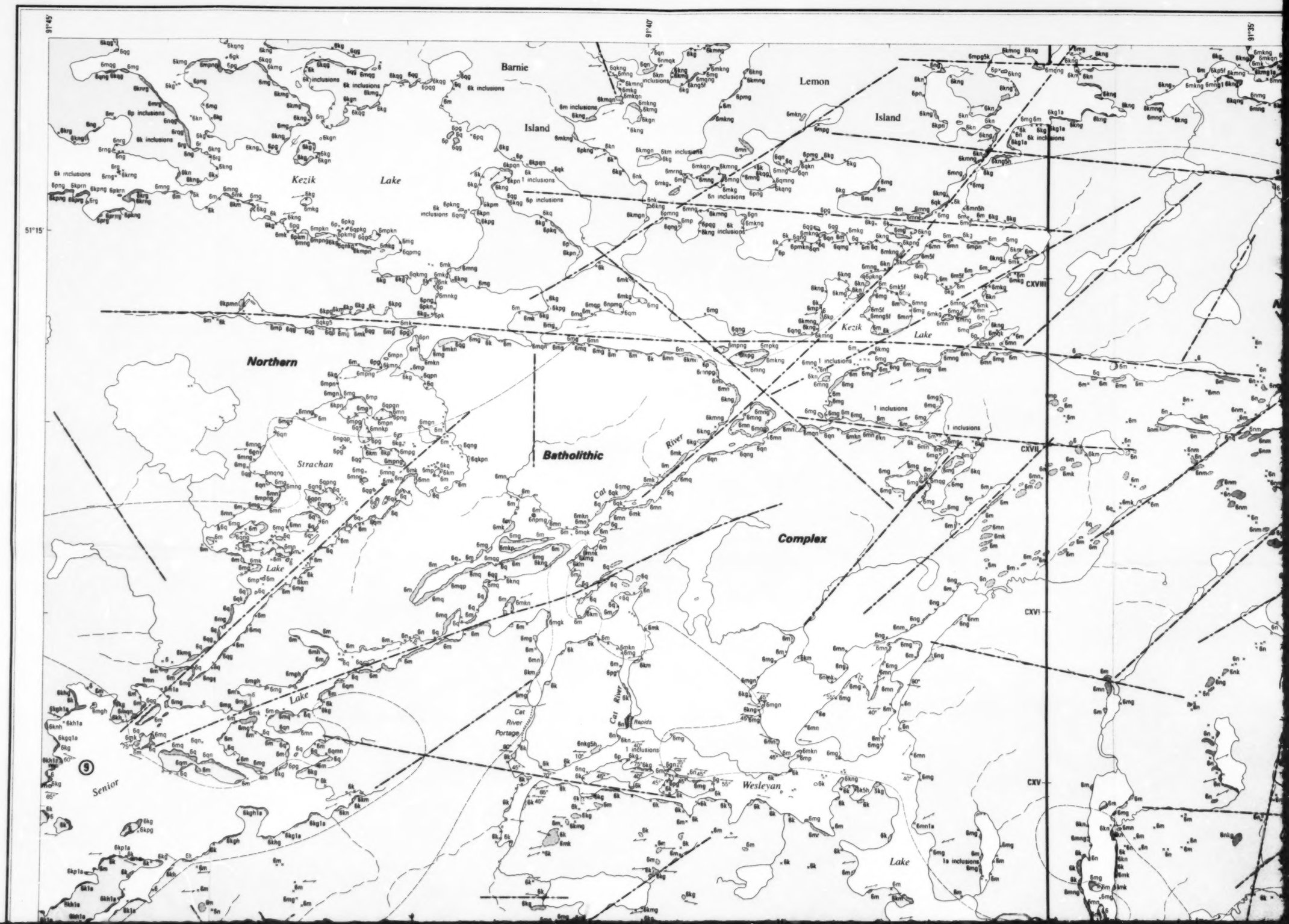
METASEDIMENTS

CHEMICAL METASEDIMENTS†

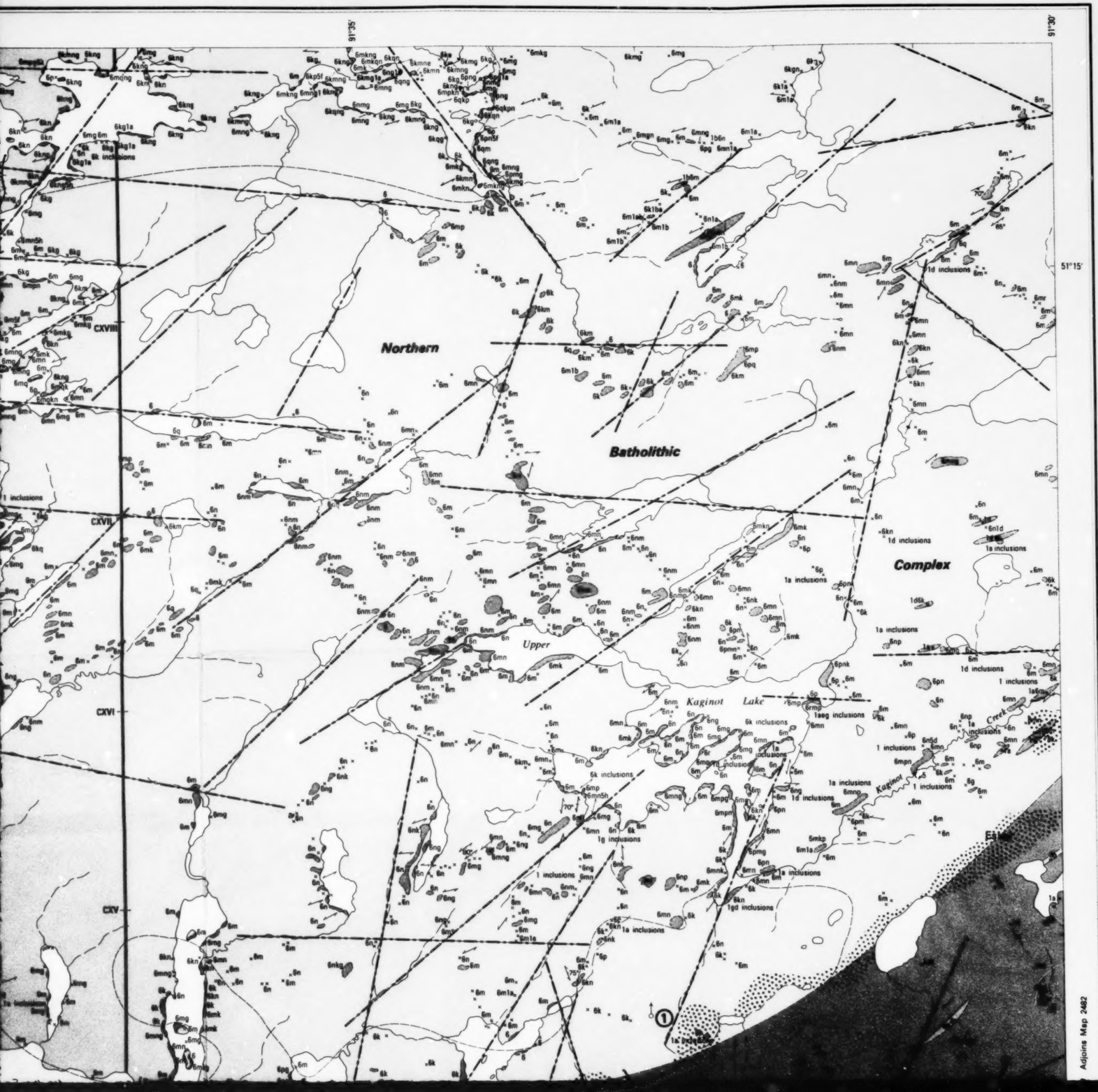
- *4 Unsubdivided.*
- *4a Chert, commonly laminated to finely bedded.*
- *4b Interbedded quartz-magnetite ironstone chert.*
- *4c Calc-silicate rock (actinolite - dolomite-calcite-biotite-quartz), massive to weakly layered.*

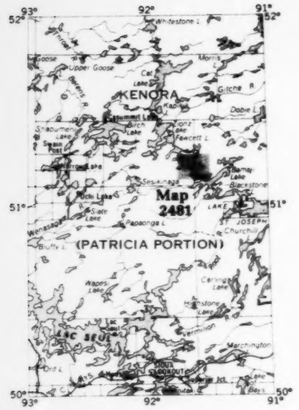
CLASTIC METASEDIMENTS

- *3 Unsubdivided.†*
- *3a Slate, argillite.*
- *3b Feldspathic wacke.*
- *3c Lithic wacke.*



Ontario Geological Survey
Map 2481
Wesleyan Lake





Scale 1 inch to 50 miles

NTS Reference 52 0/4, 52 0/5

SYMBOLS

- *Glacial striae. Glacial fluting or drumlin.*
- *Esker.*
- *Bedrock. (small outcrop, area of outcrop).*
- *Bedding, horizontal.*
- *Bedding, top unknown; (inclined, vertical).*
- *Bedding, top indicated by arrow; (inclined, vertical, overturned).*
- *Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).*
- *Bedding, top (arrow) from cross bedding; (inclined, vertical, overturned).*
- *Bedding, top (arrow) from relationship of cleavage and bedding, (inclined, overturned).*
- *Lava flk w; top (arrow) from pillows shape and packing. Lava flow; top in direction of arrow.*
- *Direction of paleocurrent.*
- *Sohistosity; (horizontal, inclined, vertical).*
- *Gneissosity; (horizontal, inclined, vertical).*
- *Foliation, (horizontal, inclined, vertical).*
- *Banding; (horizontal, inclined, vertical).*
- *Lineation with plunge.*
- *Geological boundary; (observed, position interpreted, deduced from geophysics).*
- *Magnetic contour value in gammas. Magnetic attraction.*
- *Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.*
- *Lineament.*
- *Jointing; (horizontal, inclined, vertical).*
- *Drag folds with plunge.*
- *Anticline, syncline, with plunge.*

PROPERTIES, MINERAL OCCURRENCES

1. *Cochenour Willans Gold Mines Ltd. [1973].*
2. *Dome Mines Ltd. – Dome Exploration (Canada) Ltd. [1974].†*
3. *Kirkland Townsite Gold Mines Ltd. [1968].†*
4. *Knappett occurrence.†*
5. *Knappett, R. (Flicka Red Lake prospect) [1947].†*
6. *Loon prospect.*
7. *McCombe Mining and Exploration Ltd. [1954].†*
8. *Sanderson option.*
9. *Senior Lake occurrences.*
10. *Tivy prospect (Cornell-Stirrett-Williams group).*
11. *Union Miniere Exploration and Mining Corp. Ltd. [1973].*
12. *Urangesellshaft Canada Ltd. (Bamaji Lake occurrences).†*

Information current to December 31, 1978.

Former properties on ground now open for staking are only shown if exploration data is available. A date in square brackets indicates last year of exploration activity. For further information see report.

† Occurs only on companion sheet.

4 *Unsubdivided.*
4a *Chert, commonly laminated to finely bedded.*
4b *Interbedded quartz-magnetite ironstone chert.*
4c *Calc-silicate rock (actinolite - dolomite-calcite-biotite-quartz), massive to weakly layered.*

CLASTIC METASEDIMENTS

3 *Unsubdivided.†*
3a *Slate, argillite.*
3b *Feldspathic wacke.*
3c *Lithic wacke.*
3d *Pebbly sandstone.*
3e *Conglomerate.*
3f *Biotite-plagioclase-quartz schists.*
3g *Paragneiss, migmatite.†*

METAVOLCANICS

FELSIC TO INTERMEDIATE METAVOLCANICS

2 *Unsubdivided.†*
2a *Massive flows, autoclastic breccia.•†*
2b *Pillowed flows, autoclastic breccia.†*
2c *Lithic, crystal-lithic tuff.*
2d *Crystal, lithic-crystal tuff.†*
2e *Lapilli-tuff.*
2f *Lapillistone.†*
2g *Tuff-breccia.†*

MAFIC TO INTERMEDIATE METAVOLCANICS

1 *Unsubdivided.*
1a *Massive, aphanitic to fine-grained flows, variolitic, autoclastic breccia.*
1b *Pillowed flows, variolitic, autoclastic breccia.*
1c *Pyroclastic rocks.†*
1d *Massive, medium-grained, amphibolite, garnetiferous amphibolite.*
1e *Gneissic, medium-grained, amphibolite, garnetiferous amphibolite.*
1g *Migmatized mafic metavolcanics.*
1h *Fragmental mafic metavolcanics (unsubdivided).*
1j *Coarse amphibolite.*

Ag *Silver.†*
Au *Gold.*
cp *Chalcopyrite.*
gf *Graphite.†*
mo *Molybdenite.*
mag *Magnetite.†*
py *Pyrite.*
q *Quartz.*
S *Sulphide mineralization.*
sp *Sphalerite.*
Th *Thorium.†*
U *Uranium.†*

---

[a] *Unconsolidated deposits. Cenozoic deposits are represented by the lighter coloured parts of the map.*

[b] *Bedrock geology. Outcrops and inferred extensions of each rock unit are shown respectively in deep and light tones of the same colour. Where in places a formation is too narrow to show in colour and must be represented in black, a short black bar appears is the appropriate block.*

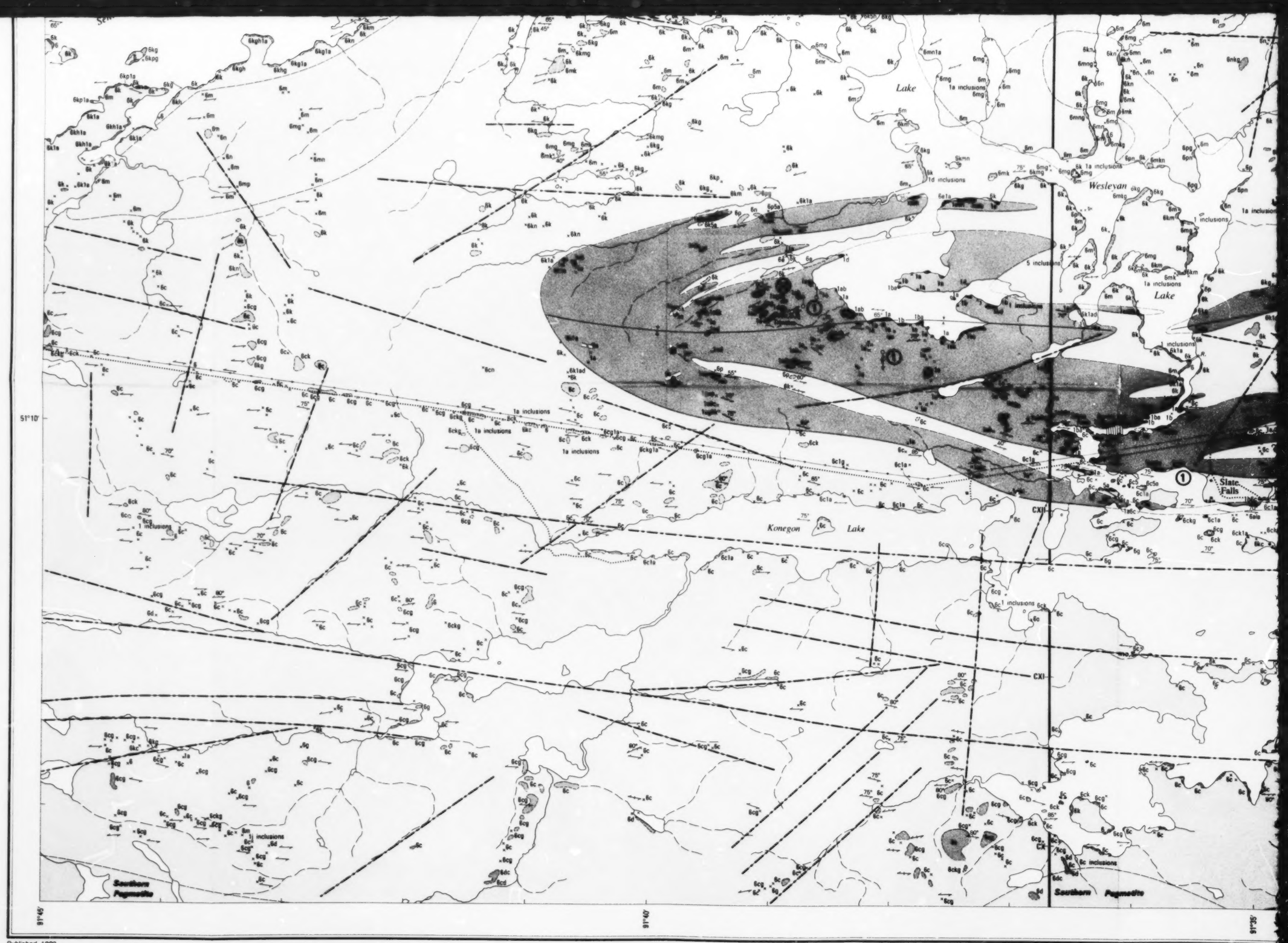
[c] *Rocks in these groups are subdivided lithologically and order does not imply age relationships within or among groups.*

[d] *Age relationships between rocks in these groups are variable and in many cases uncertain.*

[e] *May in part be intrusive.*

The letter "G" preceding a rock unit number, for example "G4" indicates that chemical metasediments are interpreted from geophysical data only.

† *Occurs only on companion sheet.*



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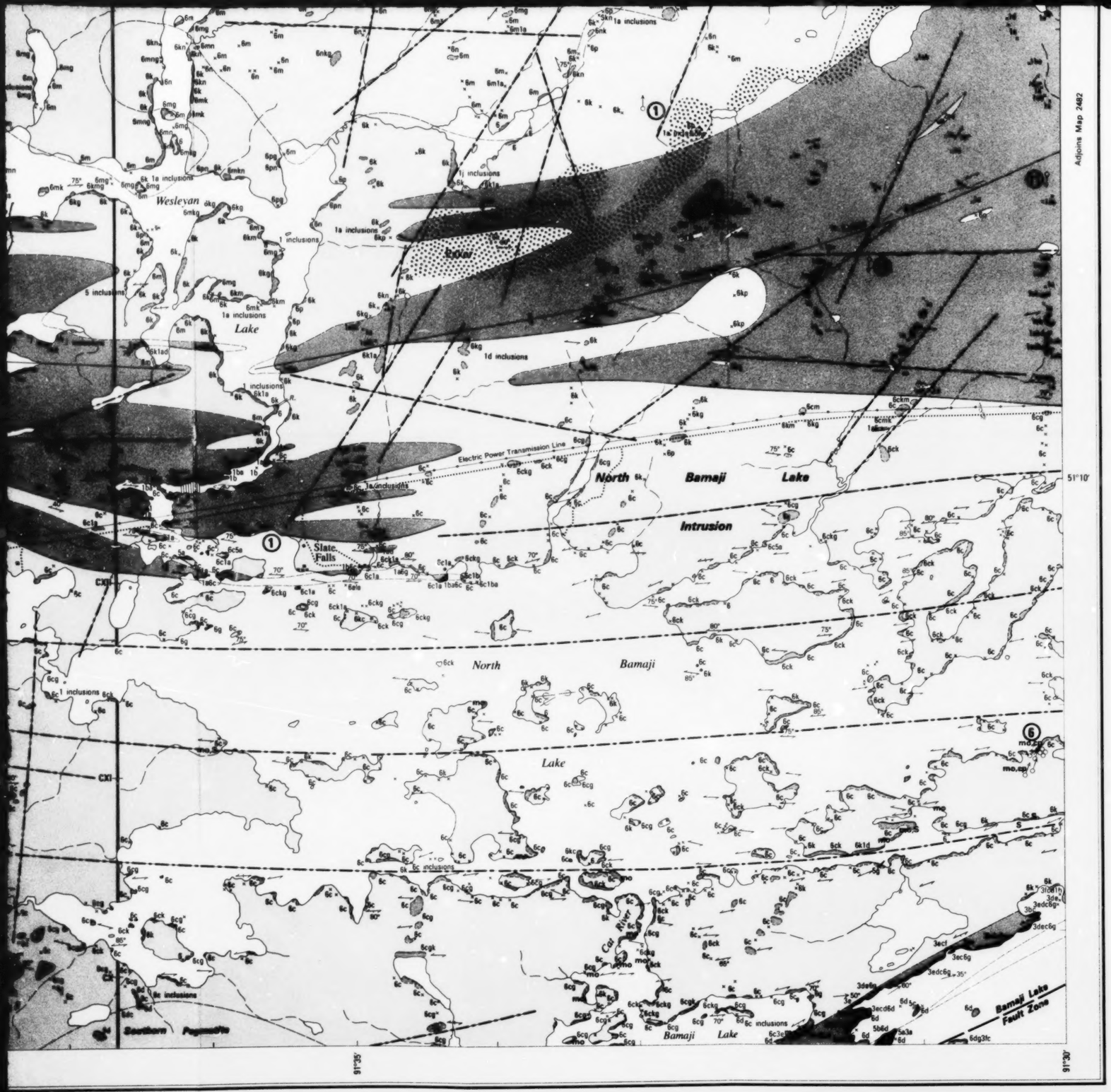


MA — Magnetic attraction.

Fault, (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.

Lineament.

Jointing; (horizontal, inclined, vertical).

Drag folds with plunge.

Anticline, syncline, with plunge.

Drill hole; (vertical, inclined, projected vertically, projected up dip). Overburden shown.

Location of sample.

Vein, vein network. Width in inches or feet.

RA — Radioactivity.

Swamp.

69 — Motor road. Provincial highway number encircled where applicable.

Other road.
Trail, portage, winter road.

International or Provincial boundary.

County, District, Regional or District Municipal Boundary, with mile post.

Municipal Boundary, (City, Town, Improvement District, Incorporated Township), with milepost.

Township, Indian Reserve, Meridian, Base Line, Provincial Park, with milepost, (surveyed, unsurveyed).

2 ① — Mining property, surveyed. Mineral deposit or mining property, unsurveyed.

Surveyed line.
Unsurveyed line.

All boundary and survey lines are approximate position only.

Some symbols may not occur on this map.

date in square brackets indicates last year of exploration activity. For further information see report.

† Occurs only on companion sheet.

SOURCES OF INFORMATION

Geology by Henry Wallace and assistants, Ontario Geological Survey, 1977-8.
Geology is not tied to surveyed lines.

Assessment Files Research Office (OGS) Toronto, files of the Resident Geologist's office, Sioux Lookout.

Aeromagnetic maps (OGS-GSC) 892G, 893G, 902G, 903G.

Ontario Department of Mines. Map 44f, Cat River-Kawinogans Lake Area, 1935.

Preliminary Maps (OGS)
P808, Bamaji Lake-Lake St. Joseph Area, scale 1 inch to 2 miles, 1973.
P1080-5, Aeromagnetic and Residual Total Intensity Magnetic Maps, scale 1 inch to ¼ mile, 1976.
P1503, Fry Lake Area (data series), scale 1 inch to ¼ mile, 1977.
P2247-8, Slate Falls (west and east parts), scale 1 inch to ¼ mile, 1979.

Cartography by P.A. Wisbey and assistants, Surveys and Mapping Branch, 1982.

Basemaps derived from maps of the Forest Resources Inventory, Surveys and Mapping Branch, with additional information by Henry Wallace.

Magnetic declination in the area was approximately 3° 45' East in 1977.

Parts of this publication may be quoted if credit is given. It is recommended that reference to this map be made in the following form.

Wallace, Henry.
1983: Wesleyan Lake, Ontario Geological Survey Map 2841, Precambrian Geology Series, scale 1 inch to ½ mile, geology 1977-8.

Ministry of Natural Resources
Ontario

Ontario Geological Survey

Map 2481

WESLEYAN LAKE

KENORA DISTRICT

Scale 1:31,680 or 1 Inch to ½ Mile

Chains 80 60 40 20 0 1 2 Miles
Metres 1000 0 1 2 3 Kilometres
Feet 1000 0 5,000 10,000 Feet

LEGEND

PHANEROZOIC

CENOZOIC[a]

QUATERNARY

PLEISTOCENE AND RECENT

Till, sand and gravel (ground moraine and esker deposits).

UNCONFORMITY

PRECAMBRIAN[b,c]

EARLY PRECAMBRIAN (ARCHEAN)

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

6 Unsubdivided.
6a Foliated, leucocratic, biotite trondhjemite, gneissic.
6b Massive to moderately foliated, hornblende, biotite-hornblende trondhjemite, quartz diorite, xenolithic.
6c Foliated, leucocratic, biotite trondhjemite, cataclastic and porphyritic.
6d Biotite, hornblende-biotite quartz monzonite, granodiorite.†
6e Feldspar-quartz porphyry, quartz porphyry.
6f Quartz-feldspar porphyry, feldspar porphyry.
6g Pegmatite, aplite (minor quartz monzonite dikes and sills).
6h Non-porphyritic felsite (minor fine-grained trondhjemite dikes).
6j Hornblende granodiorite, syenodiorite, porphyritic and foliated.
6k Equigranular, leucocratic, biotite trondhjemite, massive to weakly foliated.
6m Massive, equigranular, biotite granodiorite.
6n Massive, biotite quartz monzonite.
6p Massive, porphyritic, biotite trondhjemite.
6q Massive, porphyritic, biotite granodiorite.
6r Massive, porphyritic, biotite quartz monzonite.

INTRUSIVE CONTACT

METAMORPHOSED MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

5 Unsubdivided.
5a Massive gabbro.
5b Porphyritic gabbro.
5c Schistose to gneissic gabbro.
5d Schistose to gneissic diorite, quartz diorite.
5e Granoblastic ultramafic amphibolite (metapyroxenite).
5f Lamprophyre.
5g Peridotite.
5h Fine-grained, equigranular, or porphyritic andesite.†

INTRUSIVE CONTACT

METAVOLCANICS AND METASEDIMENTS[d]

METASEDIMENTS

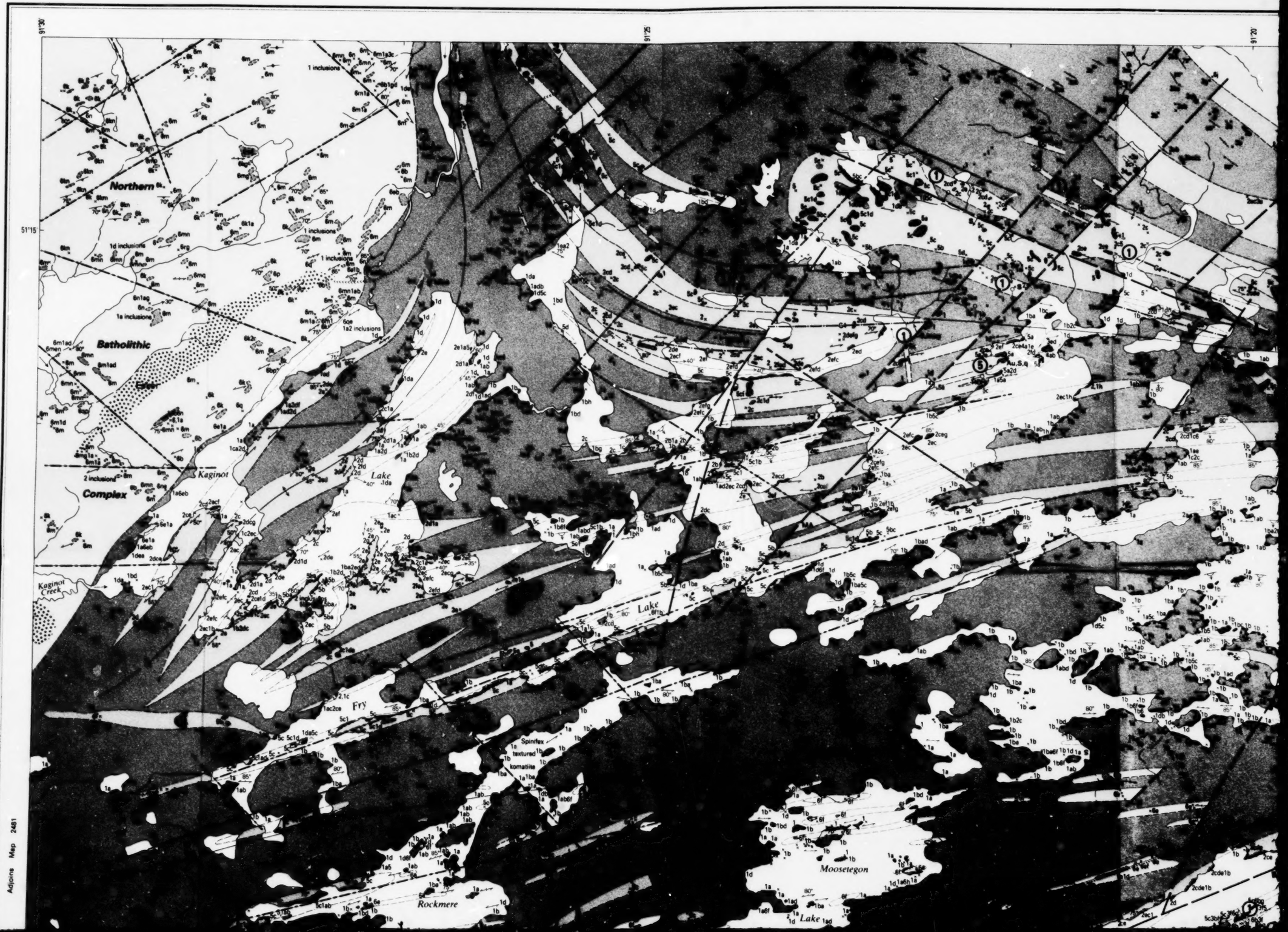
CHEMICAL METASEDIMENTS

4 Unsubdivided.
4a Chert, commonly laminated to finely bedded.
4b Interbedded quartz-magnetite ironstone chert.
4c Calc-silicate rock (actinolite - dolomite-calcite-biotite-quartz), massive to weakly layered.

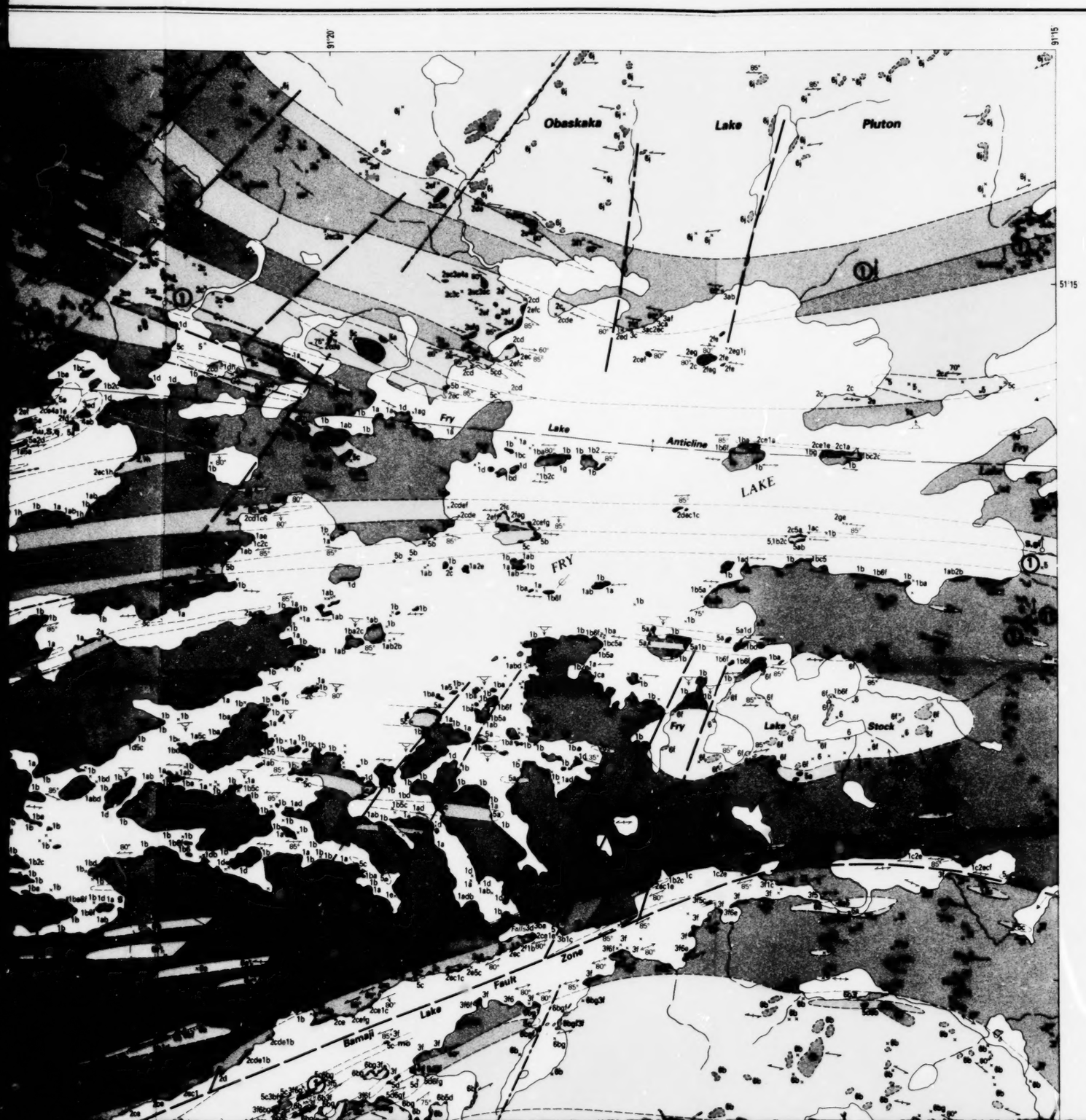
CLASTIC METASEDIMENTS

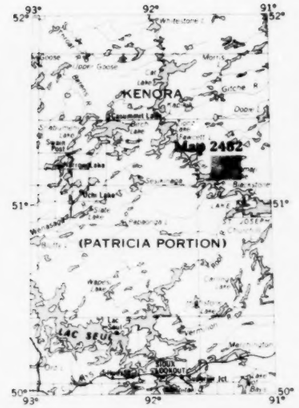
3 Unsubdivided.
3a Slate, argillite.
3b Feldspathic wacke.
3c Lithic wacke.

Adjoins Map 2481



Ontario Geological Survey
Map 2482
Moosetegon Lake





Scale 1 inch to 50 miles

NTS Reference 52 0 3, 52 0 6

SYMBOLS

- *Glacial striae. Glacial fluting or drumlin.*
- *Esker.*
- *Bedrock; (small outcrop, area of outcrop).*
- *Bedding, horizontal.*
- *Bedding, top unknown; (inclined, vertical).*
- *Bedding, top indicated by arrow; (inclined, vertical, overturned).*
- *Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).*
- *Bedding, top (arrow) from cross bedding; (inclined, vertical, overturned).*
- *Bedding, top (arrow) from relationship of cleavage and bedding; (inclined, overturned).*
- *Lava flow; top (arrow) from pillows shape and packing. Lava flow; top in direction of arrow.*
- *Direction of paleocurrent.*
- *Schistosity; (horizontal, inclined, vertical).*
- *Gneissosity; (horizontal, inclined, vertical).*
- *Foliation; (horizontal, inclined, vertical).*
- *Banding; (horizontal, inclined, vertical).*
- *Lineation with plunge.*
- *Geological boundary; (observed, position interpreted, deduced from geophysics).*
- *Magnetic contour value in gammas. Magnetic attraction.*
- *Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.*
- *Lineament.*
- *Jointing; (horizontal, inclined, vertical).*
- *Drag folds with plunge.*

PROPERTIES, MINERAL OCCURRENCES

1. *Cochenour Willans Gold Mines Ltd. [1973].*
2. *Dome Mines Ltd. – Dome Exploration (Canada) Ltd. [1974].*
3. *Kirkland Townsite Gold Mines Ltd. [1968].*
4. *Knappett occurrence.*
5. *Knappett, R. (Flicka Red Lake prospect) [1947].*
6. *Loon prospect.†*
7. *McCombe Mining and Exploration Ltd. [1954].*
8. *Sanderson option.†*
9. *Senior Lake occurrences.†*
10. *Tivy prospect (Cornell-Stirrett-Williams group).†*
11. *Union Miniere Exploration and Mining Corp. Ltd. [1973].*
12. *Urangesellshaft Canada Ltd. (Bamaji Lake occurrences).*

Information current to December 31, 1978.

Former properties on ground now open for staking are only shown if exploration data is available. A date in square brackets indicates last year of exploration activity. For further information see report.

† Occurs only on companion sheet.

4 Unsubdivided.
4a Chert, commonly laminated to finely bedded.
4b Interbedded quartz-magnetite ironstone chert.
4c Calc-silicate rock (actinolite - dolomite-calcite-biotite-quartz), massive to weakly layered.

CLASTIC METASEDIMENTS

3 Unsubdivided.
3a Slate, argillite.
3b Feldspathic wacke.
3c Lithic wacke.
3d Pebbly sandstone.
3e Conglomerate.
3f Biotite-plagioclase-quartz schists.
3g Paragneiss, migmatite.

METAVOLCANICS

FELSIC TO INTERMEDIATE METAVOLCANICS

2 Unsubdivided.
2a Massive flows, autoclastic breccia*
2b Pillowed flows, autoclastic breccia.
2c Lithic, crystal-lithic tuff.
2d Crystal, lithic-crystal tuff.
2e Lapilli-tuff.
2f Lapillistone.
2g Tuff-breccia.

MAFIC TO INTERMEDIATE METAVOLCANICS

1 Unsubdivided.
1a Massive, aphanitic to fine-grained flows, variolitic, autoclastic breccia.
1b Pillowed flows, variolitic, autoclastic breccia.
1c Pyroclastic rocks.
1d Massive, medium-grained, amphibolite, garnetiferous amphibolite.
1e Gneissic, medium-grained, amphibolite, garnetiferous amphibolite.
1g Migmatized mafic metavolcanics.
1h Fragmental mafic metavolcanics (unsubdivided).
1j Coarse amphibolite.

Ag Silver.
Au Gold.
cp Chalcopyrite.
gf Graphite.
mo Molybdenite.
mag Magnetite.
py Pyrite.†
q Quartz.
S Sulphide mineralization.
sp Sphalerite.†
Th Thorium.
U Uranium.

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*Unconsolidated deposits. Cenozoic deposits are represented by the lighter coloured parts of the map.

bBedrock geology. Outcrops and inferred extensions of each rock unit are shown respectively in deep and light tones of the same colour. Where in places a formation is too narrow to show in colour and must be represented in black, a short black bar appears in the appropriate block.

cRocks in these groups are subdivided lithologically and order does not imply age relationships within or among groups.

dAge relationships between rocks in these groups are variable and in many cases uncertain.

*May in part be intrusive.

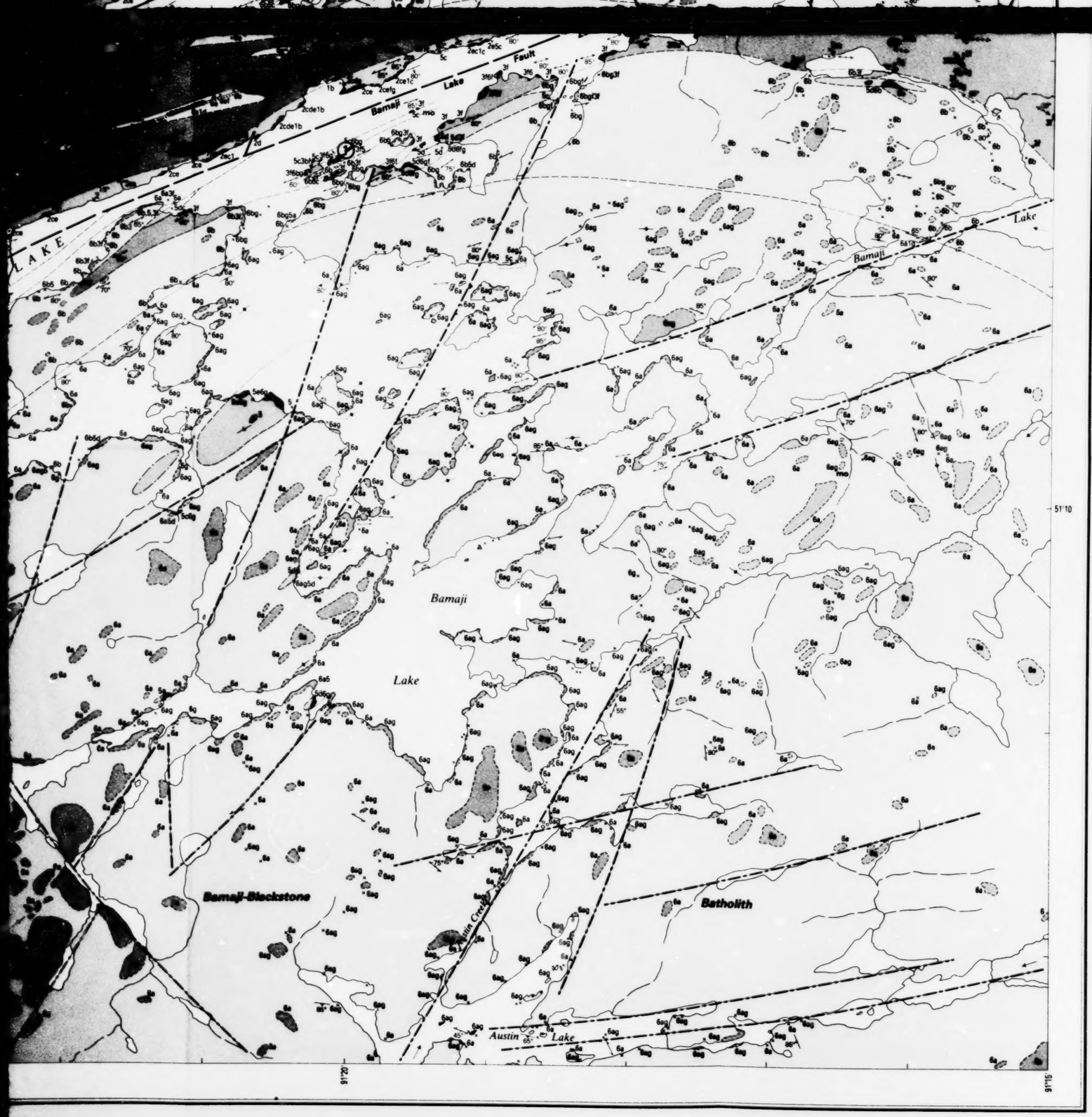
The letter "G" preceding a rock unit number, for example "G4" indicates that chemical metasediments are interpreted from geophysical data only.

† Occurs only on companion sheet.

Adjoins Map 2481

Rockmere Lake
Moosetegon Lake
Don's Lake
Bamaji Lake
Bamaji
North
Intrusion
Lake
Electric power transmission line
U,Th
1a inclusions
Fault
Zone
BAMAJI LAKE
Bamaji-Blackstone
51°30'
51°25'
51°20'

Published 1983



MA — Magnetic attraction

Fault, (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement

Lineament

Jointing, (horizontal, inclined, vertical)

Drag folds with plunge

Anticline, syncline, with plunge

Drill hole, (vertical, inclined, projected vertically, projected up dip). Overburden shown.

Location of sample

Vein, vein network. Width in inches or feet

RA — Radioactivity

Swamp

69 — Motor road. Provincial highway number encircled where applicable

Other road.
Trail, portage, winter road

International or Provincial boundary

County, District, Regional or District Municipal Boundary, with mile post

Municipal Boundary, (City, Town, Improvement District, Incorporated Township), with milepost

Township, Indian Reserve, Meridian, Base Line, Provincial Park, with milepost, (surveyed, unsurveyed)

2 ① — Mining property, surveyed. Mineral deposit or mining property, unsurveyed

Surveyed line
Unsurveyed line

All boundary and survey lines are approximate position only

Some symbols may not occur on this map.

are only shown if exploration data is available. A date in square brackets indicates last year of exploration activity. For further information see report.

† Occurs only on companion sheet

SOURCES OF INFORMATION

Geology by Henry Wallace and assistants, Ontario Geological Survey, 1977-8
Geology is not tied to surveyed lines

Assessment Files Research Office (OGS) Toronto, files of the Resident Geologist's office, Sioux Lookout

Aeromagnetic maps (OGS-GSC) 892G, 893G, 902G, 903G

Ontario Department of Mines, Map 441, Cat River-Kawinogans Lake Area, 1935

Preliminary Maps (OGS)
P808, Bamaji Lake-Lake St. Joseph Area, scale 1 inch to 2 miles, 1973
P1080-5, Aeromagnetic and Residual Total Intensity Magnetic Maps, scale 1 inch to ¼ mile, 1976
P1503, Fry Lake Area (data series), scale 1 inch to ¼ mile, 1977
P2247-8, Slate Falls (west and east parts), scale 1 inch to ¼ mile, 1979

Cartography by P.A. Wisbey and assistants, Surveys and Mapping Branch, 1982

Basemaps derived from maps of the Forest Resources Inventory, Surveys and Mapping Branch, with additional information by Henry Wallace

Magnetic declination in the area was approximately 3° 45' East in 1977

Parts of this publication may be quoted if credit is given. It is recommended that reference to this map be made in the following form.

Wallace, Henry
1983, Moosetegon Lake, Ontario Geological Survey, Map 2482, Precambrian Geology Series, scale 1 inch to ½ mile, geology 1977-8

Ministry of Natural Resources
Ontario

Ontario Geological Survey

Map 2482

MOOSETEGON LAKE

KENORA DISTRICT

Scale 1:31,680 or 1 Inch to ½ Mile

Chains 80 60 40 20 0 1 2 Miles
Metres 1000 0 1 2 3 Kilometres
Feet 1000 0 5,000 10,000 Feet